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PROCEEDINGS OF

THE LINNEAN SOCIETY OF LONDON

158th Session (1945–46)

Vol. 158 **Part 1**

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[EDITORIAL NOTE.—To facilitate citation, it has been decided to give the 'Proceedings' Volume-numbers, beginning with Vol. 158, which has been chosen as the arbitrary number and which agrees with the number of the Session.]

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PROCEEDINGS OF

THE LINNEAN SOCIETY OF LONDON

158th Session (1945-6)

Vol. 158 Part 1

PROCEEDINGS OF THE GENERAL MEETING

25 October 1945

Mr. A. D. Cotton, O.B.E., President,
in the Chair.

The Proceedings of the General Meeting held on Thursday, 21 June 1945, having been circulated, were taken as read and confirmed.

The following were thanked for gifts made to the Library since the last meeting :—Dr. L. H. Bailey, Mr. W. B. Bett, Mr. I. H. Burkill, Dr. F. Børgesen, Miss M. S. Campbell, Dr. W. E. Collinge, Dr. E. G. Davies, Dr. R. Gurney, Mr. H. S. P. Hindley, Dr. A. T. Hunziker, Miss F. H. B. Marsh, Prof. L. Newton, Dr. G. Rudorf, Prof. James Small, Mr. E. E. Tasker, Dr. George Taylor, Mr. J. W. Walton and Prof. F. E. Weiss.

The following Fellows signed the Obligation in the Roll and Charter Book, and were Admitted Fellows :—Mr. Michael Curtis Rawlence, Mr. Harold Vincent Rose, Mr. Eric Walker Baxter and Dr. Leo Cernosvitos.

The President reported the deaths of Dr. Catherine Alice Raisin, Dr. George Valentine Chapman Last and Mr. Henry Haselfoot Haines, C.I.E., Fellows of the Society ; Prof. Gustav Senn, Dr. Paul Pelseneer, Dr. Gottlieb Haberlandt, Dr. Seiitiro Ikenô and Prof. Karl Tubeuf, Foreign Members.

The President read the following excerpt from a report by Prof. Eric Ashby, Chargé d'Affaires attached to the Australian Embassy, Moscow, on the 220th Aniversary of the Academy of Sciences of the U.S.S.R.,—

> ' At the formal session in Leningrad in the Philharmonic Hall I had the opportunity to speak, and I conveyed to the President of the Academy the congratulations of the Linnean Society on the occasion of the Academy's 220th anniversary. Then I announced that Academician Komarov had been elected to the honour of foreign membership of the Society, and in the name of the Linnean Society I welcomed him to its membership. There was very enthusiastic applause at this announcement ; and the Council can, I think, be satisfied that their recognition of Komarov's work has been received with great satisfaction in the U.S.S.R., and has notably contributed to a rekindling of understanding between scientists in the U.S.S.R. and Britain.'

The following communications were read and discussed :—

Mr. A. J. WILMOTT. Australasian *Junci* in Bedfordshire. [Exhibit.] (Discussed by Mrs. F. Perry, Dr. W. B. Gourlay, Mr. J. E. Dandy, Mr. E. W. B. H. Milne-Redhead, Col. F. C. Stern ; Mr. Wilmott replied.)

Professor H. HARTRIDGE, F.R.S. The direction of the flight of bats by means of sound waves. (Discussed by Mr. A. J. Wilmott, Prof. F. E. Weiss, Dr. H. A. Baylis, Dr. Harrison Matthews, Mr. H. W. Parker, Mr. B. S. Vesey-FitzGerald ; Prof. Hartridge replied.) [Cf. *Nature*, 27 October 1945, pp. 490–4.]

Mr. JAMES HORNELL. How did the Sweet Potato reach Oceania ? [Printed in full in Journal, Botany, no 348.]

The following paper was read in title :—

'Secondary thickening and lenticels in *Avicennia nitida* Jacq.' By Dr. V. J. CHAPMAN. [Printed in full, below.]

SECONDARY THICKENING AND LENTICELS IN AVICENNIA NITIDA JACQ.

By V. J. CHAPMAN.

Since writing the account of the morphology of *Avicennia nitida* (Chapman, 1944) the four year old plant growing in the Cambridge Botanic Gardens (*ibid.* p. 423) has succumbed and the opportunity has been taken to investigate further outstanding points.

On investigation the plant was found to have only one more or less moribund pneumatophore which had not appeared above the surface of the soil. This tends to confirm the suggestion made in 1944 that the development of the pneumatophore is a problem capable of experimental treatment by varying the environment. The death of the plant was almost certainly caused by its removal to a house with a lower temperature. More recent attempts, during 1945, at transplanting mangrove plants in Ceylon, where conditions are more optimal, have shown that these species are extremely susceptible to movement. Their growth rate is so slow that roots are unable to recover from any injury before the plant has succumbed. It is probable that these maritime plants can be grown to an older age than this example, but on the experience gained it may be suggested that four conditions require to be fulfilled :

(*a*) The plant should be grown from the start in a pot sufficiently large so that later changes of container are not necessary.

(*b*) Arrangements should be made so that the plant is not continally water-logged.

(*c*) Artificial accretion should be maintained by periodically adding a thin layer of soil around the plant.

(*d*) The temperature should not be allowed to drop below 50° F. during the winter months.

Secondary thickening in the stem of this species is brought about through the development of successive extra-fascicular cambial rings. Suggestions that the successive rings correspond to annual rings (Van Tieghem, 1898), or that they are related to the alternation of wet and dry seasons (Chapman, 1944, p. 503) have never been proved. The death of the Cambridge plant has provided the first opportunity of testing these hypotheses. The age of the plant was known accurately because it was formed in the early summer of 1939 and died in December 1943. A section taken at the base of the plant had the appearance shown in fig. 1. There is a complete ring for each of the years 1939–43. The 1943 ring is nearly complete but not quite, and there is evidence of the beginning of the 1944 ring. It has already been noted (*ibid.* 502) that the outer rings in adult plants are not always complete, and it would seem that there may be some lag in development, perhaps related to an unequal distribution of growth substances. If each stelar ring is indeed an annual phenomenon and represents the activities of a cambium over twelve months, then the 1944 ring would seem to be ahead of schedule. On the other hand, if the rings represent wet and dry seasons then there is again one superfluous ring : moreover, the plant had been maintained throughout its short life under constant conditions, so that on this basis some modification of secondary growth might have been expected. The evidence from this particular plant suggests that there is a correlation between the number of stelar rings and age of the plants, although the correlation is not so precise as that of temperate trees and their annual rings.

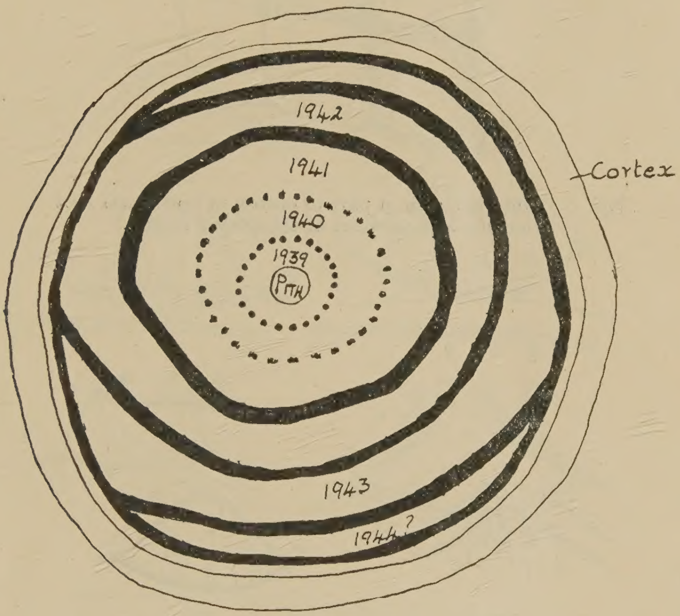

FIG. 1.—Section from the base showing the successive steles.

In the 1944 account it was pointed out that in the centre of the cortex of the primary adventitious and horizontal roots an extensive system of thickening rods develops in special cells or idioblasts : this is in contrast to the pneumatophore where the idioblasts are isolated. The thickenings are lignified and obviously serve a mechanical function in maintaining the air spaces of the cortex against collapse as a result of pressure from the surrounding soil. In fig. 92 (Chapman, 1944) these bands were illustrated only in transverse section where their arrangement around the cells was not made clear. In fig. 2 of the present paper their appearance in the solid is shown in order to give some idea of the manner in which the system is built up.

A brief account (p. 517) was given in 1944 of the lenticels that are to be found in the pneumatophores, but at that time the development of the lenticels had not been studied. A whole series of sections have since been prepared from both rough and smooth pneumatophores illustrating the process. The primary stage, however, was found in one of the horizontal roots of the Botanic Garden plant. Liebau (1913) investigated this problem in the case of the old world species, *Avicennia officinalis*, when he pointed out that the accounts of the two

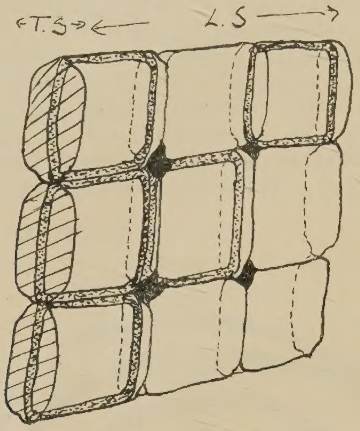

Fig. 2.—Solid diagram of part of cortex of horizontal root, showing arrangement of thickening rods.

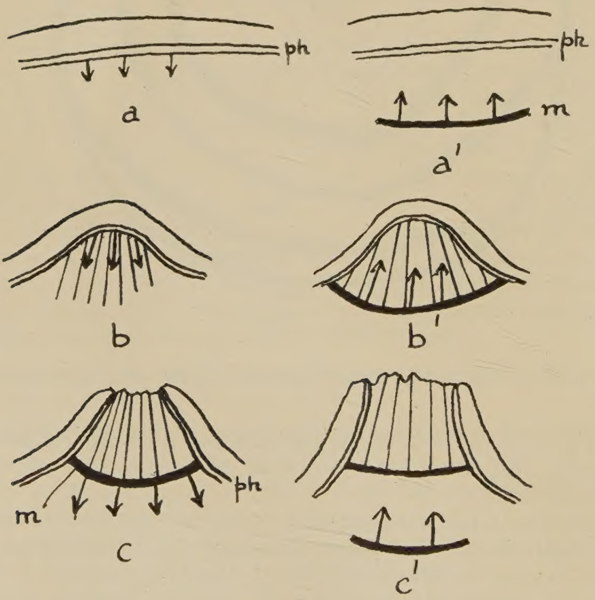

Fig. 3.—*a–c*, Stages in development according to Schenck. *a–c* , Stages in lenticel development according to Goebel. *ph*=cork phellogen. *m*=inner meristematic zone of lenticel.

earlier investigators, Schenck (1889) and Goebel (1886) appeared to be at variance. The former worked on the same species as Liebau whilst the latter studied the pneumatophores of *Sonneratia alba*. According to Schenck lenticels originate by the cork phellogen producing on the inside numerous radial rows of roundish cells ; these form a compact body of tissue which arches to the outside and ultimately pierces the cork sheath. Goebel, on the other hand, maintained that in *Sonneratia* the lenticular cells originated from a submerged cambium which budded off radial rows of cells towards the exterior. In Schenck's view the divisions are centripetal whereas according to Goebel they are centrifugal (fig. 3). In either case sooner or later a new phellogen would be formed further down in the cortical tissue and this would divide as before.

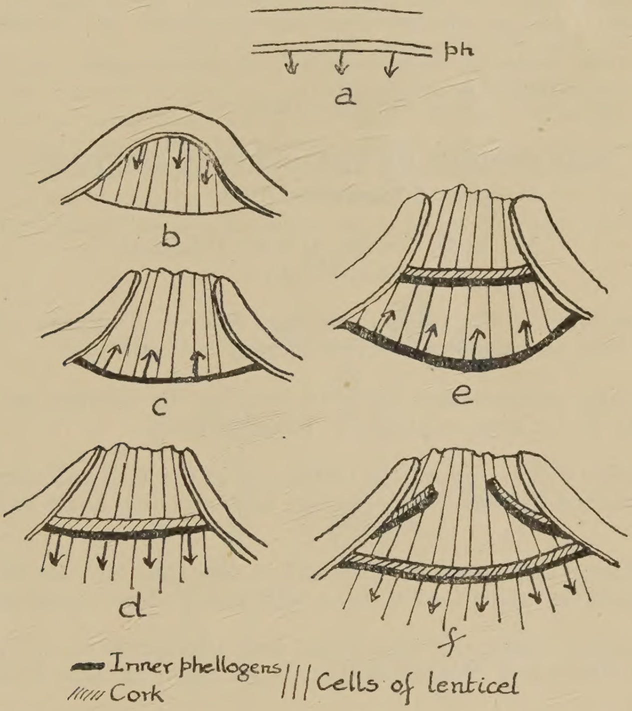

Fig. 4.—Diagrams illustrating the process of lenticel formation in the pneumatophores of *Avicennia nitida.*

Liebau re-investigated this problem and pointed out that preliminary examination rather suggested that both Schenck and Goebel might be correct, and that therefore there would be no uniformity in lenticel development. More detailed study indicated that the two diverse views might be reconciled in the following manner. Lenticel formation begins first of all from the normal cork phellogen which gives rise, in a centripetal direction, to a number of cells in the manner described by Schenck. Soon, however, an inner cambium develops at the end of these radial rows and division changes into a centrifugal direction, the innermost cells now remaining meristematic. Sooner or later, however, there is a return to the centripetal order and the change from centripetal to centrifugal division and *vice-versa* repeats itself from time to time.

A study of the development of lenticels in the pneumatophores of *Avicennia nitida* showed that these changes of meristematic activity also appeared to hold good for this species. In the first phase the meristematic cells are formed by the cork phellogen and the divisions are centripetal. Later the terminal region of the centripetally formed tissue becomes meristematic and cell division takes place centrifugally. This apparently continues until true cork cells are formed which seal the lenticel. When this happens the inner cells of the same phellogen become active and centripetal division starts once more. The whole process of lenticel formation can be represented diagrammatically as in fig. 4, and it is evident, therefore, that Liebau was correct in stating that the conflicting views of Schenck and Goebel could be reconciled.

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PROCEEDINGS OF THE GENERAL MEETING

8 November 1945

Mr. A. D. COTTON, O.B.E., President,
in the Chair.

The Proceedings of the General Meeting held on Thursday, 25 October 1945, having been circulated, were taken as read and confirmed.

The following were thanked for gifts made to the Library since the last meeting :—Mr. F. C. Grigg and Capt. F. Kingdon Ward.

The following Fellows signed the Obligation in the Roll and Charter Book, and were Admitted Fellows :—Mr. Herbert Kenneth Airy Shaw and Mr. John Grant Roger.

The PRESIDENT mentioned the difficulty in providing milk for the Society's Teas, and stated that donations of dried milk from Fellows would be welcome.

The PRESIDENT announced that it had been decided to cancel the General Meeting on 6 December 1945 as the papers set down for that Meeting could not be given.

The following communications were read and discussed :—

Dr. G. F. HERBERT SMITH. The texture of Ivory. (Exhibit.) (Discussed by Dr. H. A. Baylis ; Dr. Herbert Smith replied.)

Dr. J. W. EVANS. Some problems associated with Feeding, Flight and Sound-production in the Hemiptera (Insecta). (Discussed by Mr. H. R. Hewer, Dr. R. Melville, Dr. B. P. Uvarov, C.M.G., Dr. Edward Hindle and Mr. F. A. Ulmer.)

Abstract.—The Hemiptera, or Sucking-bugs, are one of the oldest and most isolated of insect Orders. Their most distinctive character is their piercing and sucking mouth-parts. The problem of the derivation of piercing mandibles from those of a biting type was discussed. The wings of certain Hemiptera, while retaining a primitive venation, have acquired certain specialisations, notably the acquisition of a transverse line of weakness. The significance of this development was discussed, together with the contribution the Hemiptera make to our knowledge of the origin and development of wings.

Sound production in insects has attained its maximum development in Cicadas. The tymbals and tympana of cicadas was described and suggestions made to account for their origin.

Mr. J. PROSKAUER. A note on the occurrence of *Protosiphon* in Britain. (Discussed by the President; Mr. Proskauer replied.) [Printed in full, below.]

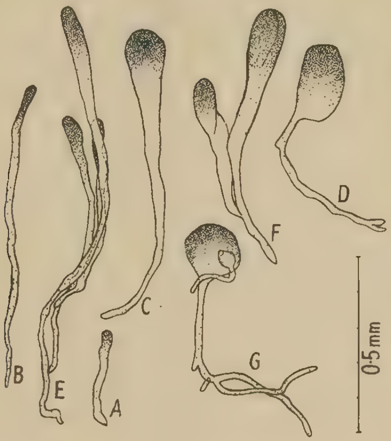
Dr. R. MELVILLE. Typification and Variation in the Smooth-leaved Elm, *Ulmus carpinifolia* Gleditsch. (Discussed by Dr. M. Skalińska.) [Paper printed in full in Journal, Botany, no. 349.]

A NOTE ON THE OCCURRENCE OF PROTOSIPHON IN BRITAIN.

By JOHANNES PROSKAUER.

Protosiphon botryoides (Kütz.) Klebs tends to grow in moist muddy situations, for instance the banks of streams and ponds, commonly in conjunction with *Botrydium granulatum* (L.) Grev., which it closely parallels. It is found in Northern and Central Europe as well as North America, and of late forms have been described from India (*P. b.* forma *parieticola* Iyengar) (4) and Egypt (*P. b.* var. *deserti* Nayal) (3, 6). The former, grading into the type but lacking a rhizoidal portion when in a dry situation, is found on walls, whereas the latter is found on desert silt and appears to have spores extremely resistant to drought. It seems to be slightly larger than the type, from which it also differs by being apparently dioecious and possessing gametes which fuse by their posterior ends.

Fig. 1.



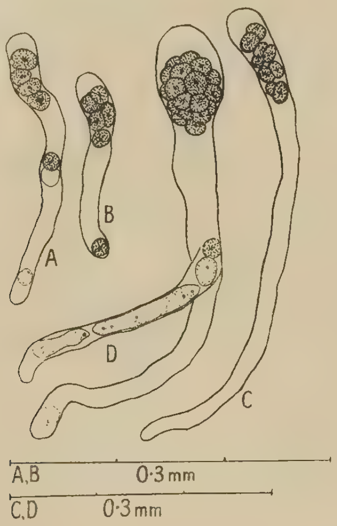
The type was clearly described by Cienowski (2) in 1855. Rostafiński and Woronin (7) in 1877 gave excellent plates and descriptions, but took it for part of the life-cycle of *Botrydium*, considering this plant to show an alternation of generations. Klebs (5) finally separated the two plants.

The present material was found growing in a Petri dish which was kept in a shaded garden frame in the grounds of the South-East Essex Technical College, Dagenham, in the latter half of May 1945. The Petri dish contained some unsterilized garden soil from the College grounds, as well as a small portion of a plant of *Anthoceros*, from Caernarvonshire. Two small but striking clusters of *Protosiphon* appeared in a different part of the Petri dish from the liverwort fragment. No *Protosiphon* plants have been observed in a considerable number of other liverwort cultures, nor in the Caernarvonshire locality where the plants were collected. On the other hand, a search for *Protosiphon* in the neighbourhood of the College so far has proved fruitless. In no case was *Botrydium* found. On the whole, it seems likely that the plant was present in the garden soil, rather than introduced with the liverwort.

The cell structure shows the features described by Klebs (5) and Bold (1). The protoplasm is highly vacuolated and the parietal layer only reaches some thickness in the upper portion of the coenocyte, which tends to be swollen into a vesicle. This vesicle is anchored to the soil by a narrow, generally colourless, rhizoidal portion. Numerous small nuclei are scattered throughout the cell. The green colour of the upper portion of the vesicle gradually fades towards the rhizoid. The parietal green layer appears reticulate and contains numerous pyrenoids. Bold holds that the chlorophyll is merely dissolved in the protoplasm and was unable to demonstrate cytologically the presence of a distinct chloroplast.

The vesicle is relatively more developed in older than in younger plants (fig. 1, A–C). Aerial and rhizoidal portions may become well defined and the rhizoid may branch (D). Tight clusters are occasionally seen (E). They may be formed by the germination of cysts from the same plant (2). In some cases they may be due to branching, generally near soil level. F shows one such case, here the two vesicles have an incomplete separation wall and share one rhizoid. Branching in the rhizoid may be considerable and vesicles are also capable of producing buds. These buds can produce their own rhizoids whilst still in organic connection with the parent plants (G).

Fig. 2.



As far as the reproduction is concerned the formation of aplanospores (‘ Coenocysts ’ of Bold) only was observed (fig. 2). As the greater portion of the protoplasm is aggregated towards the upper end it is there that the spores are concentrated (C). Frequently, however, a small portion of rounded off protoplasm remains at the tip of the rhizoid (A and lower branch of D), which may later form another spore (B) or become invested by a distinct wall and grow inside the wall of the original plant (upper limb of D) (see (5)). The pore in the centre of A is probably the place where a branch has broken off.

The material was investigated as soon as it was found and a few microscopical preparations were made. The culture had to be left for some three days, during which the *Protosiphon* entirely disappeared from the Petri dish. The fact that cysts were being formed may indicate that conditions had become unfavourable, there is also the possibility that the plants fell prey to the ubiquitous collembola. Constant attempts to revive the culture have proved unsuccessful.

All drawings except fig. 2, C–D, were made with a camera lucida.

My thanks are due to Dr. F. W. Jane for his interest and advice.

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PROCEEDINGS OF THE GENERAL MEETING
22 November 1945

Mr. A. D. COTTON, O.B.E., President,
in the Chair.

The Proceedings of the General Meeting held on Thursday, 8 November 1945, having been circulated, were taken as read and confirmed.

The following were thanked for gifts made to the Library since the last meeting :—Dr. W. E. Collinge, Mr. F. C. Grigg, Lieut. Eric Hardy and Dr. A. E. Porsild.

The following Fellow signed the Obligation in the Roll and Charter Book, and was admitted a Fellow :—Mr. Thomas Gaskell Tutin.

The PRESIDENT referred to an informal celebration that had been held in the Meeting Room during the afternoon, when some old students and other friends of Professor F. E. WEISS met to congratulate him on the eightieth anniversary of his birthday (2 November) ; and added the congratulations of the Meeting then assembled. Professor Weiss acknowledged the congratulations and made a few remarks in reply.

The following communications were read and discussed :—

Dr. V. J. CHAPMAN. Vegetation of Ceylon. (Discussed by Dr. E. F. Warburg, Mr. A. H. G. Alston, Mr. C. H. Hooper, Mr. I. H. Burkill and the President ; Dr. Chapman replied.)

Abstract.—

This communication dealt with the application of air photography, coupled with ground checks, to problems of plant ecology and plant geography as exemplified by the vegetation of Ceylon. During the war considerable advances in photographic technique have been made and much more of botanical value

can be obtained from air photographs than was formerly the case. Ceylon is a very suitable area for a study of this nature, because there is a very wide range of vegetation types. Furthermore the climate, soil and geology have been studied and mapped, and there is considerable variation in altitude.

Dr. S. M. MANTON. Adaptations correlated with size in Giant Hydroids. (Discussed by Dr. Malcolm Smith, Dr. V. J. Chapman, Mr. F. C. Grigg and the President ; Dr. Manton replied.)

Abstract.—

Two specimens of *Myriothela penola* were collected by the British Grahamland Expedition. The hydroid head is almost a yard long, the hydrocaulus being absent. *M. penola* and *Branchiocerianthus imperator*, where giant size is also attained, both show indefinitely prolonged growth from definite growth zones, and thus show no fixed specific size. Both live in cold seas, but in different regions. The excellent preservation of *M. penola* has made possible a detailed examination of its structure, growth and reproduction, all of which are modified in the attainment of giant size.

PROCEEDINGS OF THE GENERAL MEETING
10 January 1946

Mr. A. D. COTTON, O.B.E., President,
in the Chair.

The Proceedings of the General Meeting held on Thursday, 22 November 1945, having been circulated, were taken as read and confirmed.

The following were thanked for gifts made to the Library since the last meeting :—Professor G. D. Hale Carpenter, Dr. A. Steven Corbet, Capt. Eric Hardy, Mr. L. P. Khanna, Dr. W. M. Docters van Leeuwen, Major Albert Pam, Carnegie Institution of Washington, and The Royal University, Uppsala.

The following Fellow signed the Obligation in the Roll and Charter Book, and was admitted a Fellow :—S./Ldr. Alex Ernest Haarer.

The President reported the deaths of Arthur Goodman, Dr. James Watt, W.S., Dr. Surendra Lal Ghose, Professor Edwin Stephen Goodrich, F.R.S., Fellows ; and Professor Vladimir L. Komarov, Foreign Member.

The following communications were read and discussed :—

Mr. S. SAVAGE. WILLIAM CURTIS (1746–1799) and the Linnean Society. (Discussed by Mr. J. S. L. Gilmour, Colonel F. C. Stern and the President.) [Printed in full, below.]

Dr. MARIA SKALIŃSKA. Exhibit illustrating similarities and differences between tetraploid and octoploid types of *Valeriana officinalis* L. (Discussed by Dr. E. K. Janaki Ammal and the President.)

Description of Exhibit.—

Herbarium specimens, photographs and graphs were exhibited to illustrate the morphological diversity within the collective species *Valeriana officinalis* L. In addition, cytological slides and drawings of the tetraploid (28 chromosomes) and the octoploid (56 chromosomes) were demonstrated. The purpose of the exhibit was to show the difficulties in distinguishing the two polyploid types on the basis of their morphology. The comparative studies were based on 115 living specimens (59 octoploids from 49 localities and 56 tetraploids from

36 localities), as well as on 146 herbarium specimens (90 presumable octoploids from 52 localities and 56 presumable tetraploids from 34 localities). One of the most striking differences between the two types is their geographical distribution: the tetraploids are limited to the southern counties and to parts of the Midlands, whereas the area of the octoploids extends from the south of England to the north of Scotland.

Within each chromosomic type there is a considerable range of morphological forms resulting from genic differentiation. This was shown by the study of the following characters: (1) Height of the flowering stems (illustrated by herbarium specimens, photographs of flowering plants and graphs). There is a very strong overlapping of the two polyploid groups with regard to this character; the graphs representing the range of variability of the height of plants from nature, as well as of those grown at Kew in approximately uniform garden conditions, show within each chromosomic type a distinct genic differentiation. (2) Beginning of flowering. Two graphs based on records taken at regular time intervals on plants in garden culture at Kew were demonstrated. They show that each polyploid type is composed of early, intermediate and late flowering strains. (3) The number of pairs of lateral leaflets in stem leaves (illustrated by graphs). On the average, the tetraploids have a somewhat higher number of lateral leaflets than the octoploids (modal value for the tetraploids—seven pairs, for the octoploids—five pairs); there is, however, a great genic diversity within each type and a distinct overlapping of the ranges of variability. In octoploids the number of leaflets ranges from three to ten, in tetraploids from five to ten pairs. (4) The shape of the lateral leaflets of the stem leaves (illustrated by herbarium specimens and by graphs). The shape of the leaflets is determined by the ratio length/width, and in addition by the toothing of the margins. The leaflets of the two polyploid types have been grouped according to their shape and size in two parallel series. In both the range begins with strongly similar (and probably genetically corresponding) linear and narrowly lanceolate leaflets of the so-called 'angustifolia' form. In the tetraploid series this form is represented chiefly by plants from chalk and oolite slopes; the extreme octoploids with narrow leaflets are native of limestone habitats; as shown in the demonstrated herbarium specimens, they may be morphologically indistinguishable from tetraploids. Parallel with the increase in size of the leaflets, however, the similarity gradually becomes less marked. This is due to the fact that in tetraploids, on the whole, the ratio length/width remains the same also in larger leaflets, whereas in octoploids there is usually a rather rapid increase in width in proportion to the leaflets' length. The graphs which were demonstrated in order to show the range of forms of the leaflets of the two polyploids, closely coincide with one another only in the part corresponding to small and narrow leaflets; on the other hand, their parts corresponding to intermediate forms show a steadily increasing divergency. The range of forms of the octoploids ends with very large and broad leaflets of the so-called 'sambucifolia' form. In the tetraploid series the corresponding morphological type is missing, and therefore the extreme plants with large and broad leaflets can be identified as octoploids. They are, however, connected with both octoploids and tetraploids by a range of intergrading forms and this renders extremely difficult a correct delimitation of the types. As it has been already mentioned, the extreme forms of octoploids with small leaflets are practically indistinguishable from tetraploids. Consequently, purely morphological criteria prove to be inadequate for distinguishing the two polyploid types. The most reliable criterion is, of course, the cytological investigation of living plants, as the demonstrated metaphase plates of the tetraploid and octoploid distinctly show. Where only herbarium specimens are available, the method of measuring the pollen grains is helpful for the estimation of the presumable chromosomic type, since the cells of the octoploids are larger than those of the tetraploids. This has been shown on two graphs which give the range of variability of the pollen diameter in 2694 grains of 59 octoploid plants (Mean in microns $55{\cdot}80 \pm 0{\cdot}07$) and in 2271 grains of 50 tetraploid plants (Mean $46{\cdot}65 \pm 0{\cdot}05$). Although the graphs overlap, the difference between the average values ($9{\cdot}15\,\mu$) is reliable for the distinction between the two types. By this method it was possible to detect several new habitats of tetraploids and to corroborate subsequently on living plants the results of the earlier estimation.

> Dr. C. R. METCALFE and Dr. C. LEIGHTON HARE. Exhibit of original drawings to illustrate a new book on the systematic anatomy of the Dicotyledons. (Discussed by Dr. T. E. Wallis ; Dr. Hare replied.)

Description of Exhibit.—

Dr. C. R. Metcalfe said that the drawings in the exhibit represented a selection of those which were being prepared to illustrate a new book on the systematic anatomy of the vegetative organs of the dicotyledons. It was decided in 1938, after discussion with the late Sir Arthur Hill and other experienced botanists, that a new book, to replace the well-known treatise on the same subject by Solereder, was badly needed. Important as it was, by modern standards Solereder's book, of which the English translation by Boodle and Fritsch was published in 1908, suffered from various defects, the most serious of which were its cumbersome style, the insufficient emphasis on recent developments such as the study of the structure of the secondary xylem in mature trees, and the lack of information concerning the structure of economic plant products. Another serious drawback was the paucity of illustrations, apart from those showing the structure of hairs, and some dealing with features of special interest.

Work on the new book was started early in 1939, in collaboration with Dr. L. Chalk of the Imperial Forestry Institute, Oxford, who undertook to prepare original descriptions of the structure of the mature secondary xylem for all of the woody families. Besides a digest of the information in Solereder's original book, the new work would include a summary of literature published since 1908 and the results of extensive fresh investigations made at Kew and Oxford. Work on the book had progressed steadily and there were reasonable hopes that it would be ready for the printers towards the end of 1946. The Clarendon Press at Oxford had undertaken publication.

The new book was to be illustrated entirely by line drawings. These were intended to show the range of structure in all of the important families, as seen in typical internodes of young stems, in the mature secondary xylem and in transverse sections through the distal ends of petioles. Less attention had been given to features of special interest, as many of these were illustrated by Solereder, and the intention was to supplement the new figures by perpetuating the more important of the old ones.

The preliminary drawings of the wood structure were made by Dr. Chalk and finished and mounted by Dr. C. L. Hare. Most of the illustrations of the stem and petiole structure were entirely prepared by Dr. Hare. It was therefore appropriate that these introductory remarks should be followed by a description from Dr. Hare himself, of the technique by which the illustrations were produced.

Dr. HARE gave a brief account of the methods employed in preparing and mounting the drawings and the principles which have governed their arrangement in plates. With a few exceptions the drawings are diagrammatic, the object being to display as clearly and simply as possible the distribution of the tissues, since this provides the most generally useful diagnostic character.

Each of the several tissues is represented by a different type of shading, selected so as to aid the eye in immediate recognition—a key to these shading conventions will be included in the book.

Most of the drawings have been made by the projection method. A microscope is used in the horizontal position and a powerful beam of light is thrown directly on to the sub-stage condenser. A small 90° prism is slipped over the eyepiece so as to deflect the rays downwards and produce a real image of the preparation on the drawing paper. The drawing is then outlined in pencil, checked under the microscope and completed in Indian ink on Bristol board. A dark room is not required, but the projected image should be lightly screened while the drawing is being made. An intense light source is however required, and the numerical aperture of the sub-stage condenser must be adjusted to suit that of the objective in use. This method of drawing is simple and accurate, it requires the minimum of preparation and greatly reduces eye strain. If the microscope is set up permanently a great saving in time is effected and drawings can be turned out very quickly.

All the drawings have been mounted with rubber solution, which has many advantages and for this purpose is much superior to the usual adhesives. A pure solution, freed from all trace of resins, should be used, and, if necessary, it should be diluted with benzene or xylol to the consistency of thin syrup. A film of the solution is spread over the mounting board and on the back of each of the drawings. The latter are then placed in position and lightly rubbed down with the fingers, no further pressure is required, and half an hour is ample time for drying. The surplus solution on the mounting board can be rubbed off with the fingers or a soft cloth, leaving the surface perfectly clean and undamaged. Although the drawings adhere firmly, they can afterwards be peeled off quite readily if so desired.

In arranging the drawings in plates, correct taxonomic sequence has been the first and overriding consideration, since this greatly facilitates reference. Within the limits imposed by this condition every endeavour has, however, been made to secure a pleasing and harmonious grouping of the figures. Although each of the plates is to this extent a compromise, it is hoped that the results will prove generally satisfactory.

'Evolution of the Buffaloes, Oxen, Sheep and Goats'. By the late GUY PILGRIM, D.Sc., F.R.S. (Communicated by Dr. A. TINDELL HOPWOOD, F.L.S.) (Discussed by Dr. Edward Hindle, F.R.S., and Dr. Malcolm Smith; Dr. Hopwood replied.) [To be printed in full in Journal, Zoology.]

WILLIAM CURTIS AND THE LINNEAN SOCIETY: WITH THREE OF HIS UNPUBLISHED PAPERS.

By S. SAVAGE.

[PLATE 1.]

WILLIAM CURTIS, the bicentenary of whose birth on 11 January 1746 at Alton, Hampshire, we commemorate today, was an example of the best type of eighteenth century naturalist. Of Quaker descent, as a boy his bent towards natural history was fostered by Thomas Legg, an ostler at the Crown Inn, Alton, who was a student of Gerard and Parkinson. Although later on Curtis acted as a demonstrator in botany whilst studying at St. Thomas's Hospital, was appointed demonstrator in botany at the Chelsea Physic Garden, and was also a practising apothecary in London, his enthusiasm for natural history became overwhelming. From 1777, until his death from heart disease at the early age of fifty-three, he worked as a lecturer on botany and as an author of works of natural history. In 1772, at the age of twenty-six, he had published an English translation of the Linnaean thesis ' Fundamenta Entomologiae ', to which he added material to bring it up to date ; and retained his interest in that science until his death. Two years later he issued anonymously his first botanical publication, ' Catalogue of plants growing wild in the environs of London '.

It is scarcely necessary to do more than mention his chief botanical works,—the magnificent ' Flora Londinensis ' and the ' Botanical Magazine ' from his founding of it in 1787 until 1799 *. Curtis had also a keen interest in ornithology, and could distinguish most English birds by their song alone.

Curtis's early ambition had been to produce a complete natural history of Great Britain, which would have been a help to all those who were interested in, and wished to identify the plants, insects and birds of their own country. In this, however, he differed from the systematist pure and simple, for in him were joined an interest in the practical side of natural history, with a desire to classify the knowledge gained, and the wish to have expressed in clear pictures what the pure systematist is usually content to have in words only.

As a practical botanist he was the first private individual to open a public botanic garden in London,—first at Lambeth Marsh † and then at Brompton, where, for a subscription he lectured, kept a library, and gave his supporters plants grown in the garden. His practical interest in horticulture was life-long and finds its best expression in his founding of the ' Botanical Magazine ', which aimed (as it still aims) at blending the scientific side of botany with a horticultural interest in the living plant. This side of his powers was recognized when about 1782 he was offered the revision of Miller's ' Gardener's Dictionary ' ; but he relinquished the task after three years and it was undertaken by Professor Thomas Martyn, who spent over twenty years on it. Up to the time of his death, Curtis had made a large collection of drawings for a projected general work on British insects ; and that interest extended to the economic side as his published papers witness.

In the excellent biography of Curtis, published by Mr. W. Hugh Curtis in 1941, his character and personal appearance are well defined. He was rather short and thick-set ; full-faced and blessed with very keen eyesight. It is recorded that he seldom used a lens in examining even the smallest plant ‡. In this biography also is a most pleasant account of his friendship with Goodenough, one of the three founders of our Society. Eventually becoming

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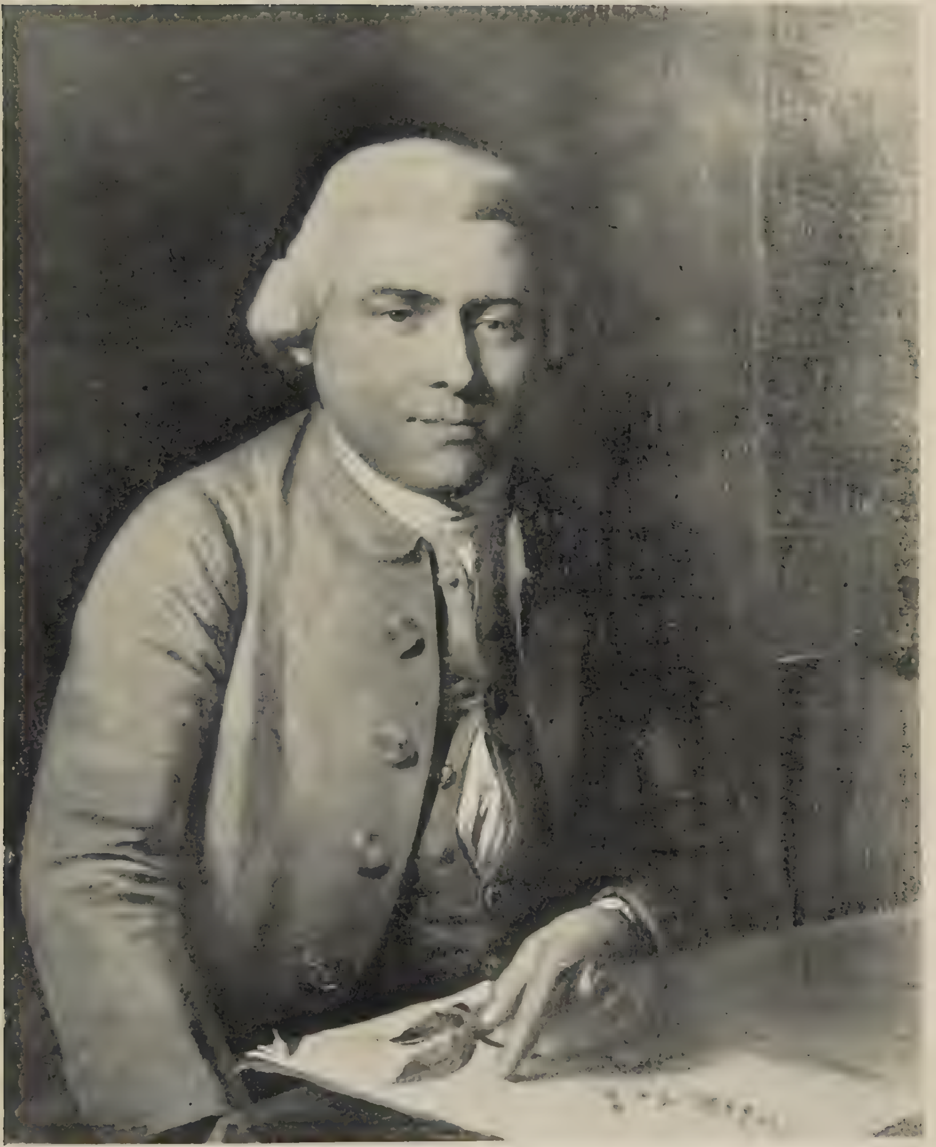
* I will, however, mention that Thomas Martyn, writing to Pulteney, on 5 March, 1787, reports, ' Mr. Curtis has started a new work, which he calls a *Botanical Magazine*, which is to exhibit the plants generally cultivated in gardens ; so that, between his *Flora* [Londinensis] and this, if he lives to the age of Methuselah, we shall have coloured figures of most plants commonly known. But, whatever *he* may do I do not think that either you or I shall live to see an end of these two works . . . ' (Gorham, ' Memoirs of John . . . and of Thomas Martyn . . ., 1830, p. 177.)

† Before 1787 James Sowerby painted a water colour of this garden. This picture has been reproduced in ' Chronica Botanica ', vol. 9, n. 2/3, 1945. The location of the garden appears to have been slightly NE. of Waterloo Station ; its position is fixed approximately by Rouppel Street, named after a later freeholder of the property, and in which was Hatch House, where Halfpenny Hatch tolls were collected from those following a footpath across Curtis's garden. The freehold land held by Mr. Rouppel amounted to about seven acres.

‡ There are three well-known portraits of him,—an engraving by W. Evans, published by Thornton ; a miniature by Angelica Kauffmann ; and an oil painting by Wright, now in the Royal Horticultural Society's collection (Plate 1). A fourth portrait is said to be an oil painting by Zoffany, which appears to be now in some art gallery in India. Recently, a small oil painting on copper by an unknown artist has been presented to the Curtis Museum, Alton, by Mr. George H. Gabb ; it has some relation to the engraving by W. Evans.



WILLIAM CURTIS.

(From the painting by Wright in the collection of the Royal Horticultural Society.)

Bishop of Carlisle, Samuel Goodenough was a schoolmaster at Ealing during most of the time of his friendship with Curtis and in 1799 was Canon of Windsor. It was a friendship that had lasted twenty-three years ; and the letters or parts of letters published by Mr. Hugh Curtis show how warm and genuine a one it was. Goodenough wrote an obituary of Curtis for the 'Gentleman's Magazine' in 1799, in which he quoted the following passage from Curtis's autobiography, a MS. which is now missing,—'I have no pretensions to be considered as a man of letters, or of great mental powers. I know myself and my imperfections. A consciousness of my inabilities makes me diffident, and produces in me a shyness, which some have been ready to construe into pride'. Goodenough adds to this,—'He was sensible that his excellence consisted in his superior discernment when applied to objects of Natural History ; in this respect he had few equals . . . . Mr. Curtis first discovered the membranous *calyptra* in mosses, [*Footnote* : See Mr. Curtis's description of the Polytrichum commune and nanum in the Flora Londinensis.] overlooked by Dillenius. To him we owe the discovery that the Violas and Oxalises produce seed all the year through, though the latter produce no petals except in the Spring, the former only sparingly in the Autumn. The distinction between Poa *pratensis* and *trivialis* by the intrafoliaceous membrane, is the result of Mr. Curtis's accurate discernment. Many others might be mentioned'.

Among other Fellows of the Society who were good friends of Curtis are Dr. J. C. Lettsom, who knew him well for many years, and at a critical time for the 'Flora Londinensis' helped him with a gift of five hundred pounds ; Dr. John Sims, who knew him from boyhood, and who edited the 'Botanical Magazine', from 1801–26 ; and Bracy Clark, well known for his works on veterinary science, helped Curtis in revising the last paper he wrote, which was on Aphides. Bracy Clark lived on until 1860, dying at the age of ninety, the 'Father of the Society'.

Curtis was one of the foundation Fellows of the Society, and he appears to have taken an active part in the early years of the Society. In 1789 he served on a committee to select papers ; and in 1792 and 1795 he was a member of the printing committee. In 1792 he showed some resentment when the president, Sir James Edward Smith and James Sowerby, began to publish 'English Botany', as he considered that the work aimed at supplanting the 'Flora Londinensis' ; but Goodenough and other friends did their best to reassure Curtis and convince him that there had been no such intention.

In this brief sketch of some of the aspects of William Curtis's connection with this Society, it remains for me to give an account of the papers he read before it. I would, however, first mention that Curtis was a member of the Society for Promoting Natural History, founded in 1782, to which both Smith and Goodenough also belonged. To that Society, which published nothing except its rules and list of members, Curtis contributed a paper on the Common Sand Wasp which has remained in manuscript, 'Observations on the *Sphex sabulosa* of Linnaeus'. In his account of Curtis, Goodenough refers to this as 'a curious and valuable paper and gave a very full detail of the history of that animal'. This Society possesses this unpublished MS., which is illustrated with an excellent coloured drawing by Sydenham Edwards (see the text-figure).

Curtis gave our own Society four papers, two of which were published and two remain in manuscript. The published papers were 'Some observations on the Natural History of the *Curculio Lapathi* and *Silpha grisea*', upon which I have no comment to make ; and the 'Observations on Aphides, chiefly intended to show that they are the principal cause of Blight in Plants, and the sole cause of the Honey-dew', published posthumously in Vol. 6 of our 'Transactions', about which I will add a few remarks. With the MS. of this paper I found a letter from Bracy Clark, as follows,—

To the President of the Linnean Society.

Dear Sir,

My late most worthy and valued friend Mr Curtis on his Death-bed requested I would prepare this Dissertation on the Aphides for the Linnean Society after his Decease. During his life time and previous to his disorder wearing any very alarming appearance I had assisted him in revising a considerable part of it and he wished me to pursue this revisal to the Conclusion of it. I therefore venture after making a few Corrections to place this excellent paper as early as possible in the Hands of the Society.

I remain with the greatest respect

Your very obed't humble Serv't

Bracy Clark.

London July 28th 1799.

[*J. Dryander, Vice-President of the Society, has added :*] Received Feb. 11, 1800.

The paper on which Curtis wrote this MS. was obtained by cutting up copies of a plate he had by him, and it is now possible to rearrange some of these leaves as a ' Plate 2 ', depicting *Fringilla flavirostris* [=*Acanthis flavirostris*], the Twite or Mountain Linnet ; ' published by Wm. Curtis, Feby. 1st, 1785 ' ; ' Syd. Edwards del. et sculp.' I do not know whether this Plate is known to ornithologists.

The main additions to the paper are in Bracy Clark's handwriting ; and the minor editorial corrections by Sir James Edward Smith scarcely merit his words in Rees's Cyclopaedia [*article,*—Curtis :], ' This paper was digested by the president from the unfinished materials of its author, and communicated to the Society after his death . . . .' He forgot to mention that Bracy Clark had any hand either in helping Curtis to revise the paper before and after his friend's death. In fact, any one who examines the MS. of this important paper will agree that its text is substantially in Curtis's handwriting ; and that Bracy Clark added some data he had found among Curtis's papers and made a few minor corrections. The drawing for the plate illustrating this paper is missing, but another drawing, of the Onion fly, bears a note by Sir J. E. Smith that it does not apply to the present paper.

Turning now to the unpublished papers, one is a short note on the larva of the Larder Beetle, *Dermestes lardarius*, read before the Society in 1788. The second paper, read in 1790, was ' Some Account of a mode of taking the *Anas ferina*, Dun-Bird or Easterling * as practised in some parts of Essex '. This is a well-written and interesting account of the method adopted for catching the Pochards [*Nyroca ferina* (Linn.)] near Maldon about the year 1786.

I would like to suggest that perhaps these three short unpublished papers might be printed in our ' Proceedings ' as a tribute to William Curtis, one of the foundation Fellows of this Society.

Mr. J. S. L. Gilmour drew attention to the ' Catalogue of London Plants ' anonymously published in 1774 and attributed to W. Curtis in Dryander's Catalogue of Sir Joseph Banks's Library (1798–1800). Despite this attribution there is no mention of the work in any of Curtis's publications after 1774 and there is other strong evidence against Curtis being the author. Mr. Gilmour asked for any suggestion or information towards solving the puzzle.

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* In his ' Dictionary of English and Folk-names of British Birds . . .,' 1913, Kirke Swann gives the name Easterling to the Wigeon.

[*Paper read before the Society for promoting Natural History on* 15 *November* 1785:]

OBSERVATIONS ON THE SPHEX SABULOSA OF LINNAEUS.

By William Curtis.

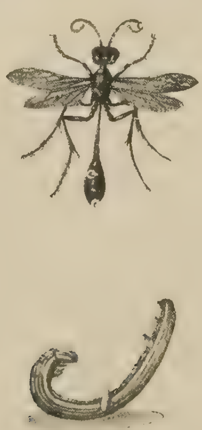
Towards the latter end of August, in the present year '85, observing in the Sand pits, and Banks, about Charlton in Kent, a great number of the *Sphex sabulosa* I thought I cou'd not employ a few leisure hours better than in observing its wonderful oeconomy. An opportunity soon presented itself. I was first struck at seeing one of these Insects flying in & out of a small hole in the ground, and each time bringing out a quantity of sand large in proportion to its size, which it drop't about two or three inches from the hole. This operation it repeated six or eight times, and then flew away. Supposing the Sphex to be gone in search of some insect to deposit in the hole it had been making, I waited for its return with impatience, but had not the good fortune to see it again. My attention was now engross'd by another Sphex which made its way out of a hole at a small distance from me and ran about the vicinity of it in search of little lumps of earth which it carried in its jaws and dropt into the hole. While I was observing this Insect another presented itself dragging along a slender body much longer than its own and which at a distance looked like a bit of straw. I now quitted the other to observe the motions of this, and on a nearer view found the substance to be a long slender striped caterpillar. This caterpillar it drew along till it came to a hole in the ground, to the edge of which it dragg'd it. The Sphex then descended into the hole and drew the caterpillar in after it. After remaining in the hole about a minute it came out and immediately began to search for the nearest small lumps of earth to be found, which it carried and deposited in the hole, scraping the sand with its feet to assist its filling and close up the interstices. Thus it continued to be employed till it had filled up the hole with lumps and sand alternately, which having compleated it flew away.

The second Sphex which we mentioned was however more nice and much longer in filling its hole, frequently descending apparently to adjust the lumps & sand ; and when it was filled to the edge it fetch'd a very large piece of earth more than it could well drag along and placed it on the mouth of the hole, after which it scraped on it a small heap of sand which it smooth'd the surface of so that not the least traces of any hole cou'd be seen & afterwards flew away. During the time that it was thus employed several Insects came near it & some of the same species, all of which it attacked with great fury and beat off.

It now remain'd for me to open these holes that I might discover what the Insects had been thus employing themselves about. I therefore dug down to the bottom of the second hole and there found a caterpillar about the size of that of the Phalaena Brassicae but discovered no egg deposited on it either externally or internally. Imagining that I might have gone rather too roughly to work I dug more cautiously round the hole of the 3d and at the bottom of it found a caterpillar somewhat longer and slenderer than that deposited in the other hole, but of a species I had not before seen, with a slender oblong egg sticking to the skin of the Caterpillar, about the middle of it and the caterpillar scarcely dead. Thus it appear'd that these Insects had been employ'd in providing for their offspring.

As this Insect approaches in its form to the Ichneumon so it has some affinity to it in this part of its oeconomy. The Ichneumon lays its eggs we believe generally in the body of the living caterpillar, Nature having furnish'd it with an instrument for piercing the skins of these animals, and this instrument is particularly long in those Ichneumons which lay their eggs in such Larvae as feed in decay'd trees and we have frequently seen them thrust their aculeus into the holes of trees its full length.

The Ichneumon generally lays many eggs, this Sphex only one ; but while on the one hand it would not be strong enough to master and carry away a Caterpillar sufficient for more than one of its larvae to feed on, on the other it takes care to bring a Caterpillar so large that its young shall not be stinted for food. As it only affixes its egg on the outside it is of course not furnished with any sting like the Ichneumon, but as it is obliged to kill its prey or at least to disable it in such a manner as to be easy of management, Nature has given it a large head furnish'd with a strong pair of forceps sufficient for the purpose, whereby it is not only enabled to master its prey but to drag it along to a considerable distance. These forceps also are used in carrying materials for closing its hole in the earth. Its legs are remarkably long and strong ; these are particularly useful to it in burrowing and scratching the sand.



The *Sphex sabulosa* Linn.
(*From a drawing by Sydenham Edwards.*)

How long the egg when deposited remains before it is hatch'd or how long the Insect remains in its larva or Pupa state we have had no opportunity of observing. The Spex sabulosa in its perfect state feeds like many other Insects on the Nectar of flowers. We have particularly observed it on the blossoms of the Hieracium umbellatum. In search of Larvae to deposit its egg on it is generally observ'd running on the ground among the herbage. The Insect it selects we believe is most commonly the Larva of some Phalaena and most probably such as feed on grass and consequently but little known.

[*Paper read before the Linnean Society on 5 August* 1788 :]

THE LARVA OF DERMESTES LARDARIUS.

By William Curtis, F.L.S.

Mr Curtis found the Larva of the *Dermestes lardarius* apparently about half grown in a piece of bladder which had been laid by ; he put it into a small oval chip box made of deal, with some fragments of the bladder, on which it fed several days and then changed its skin. It afterwards continued to feed till from its size it was judged to be fully grown ; when instead of changing to its pupa state in the box as he expected it eat its way through the lid which was nearly a quarter of an inch thick and made its escape.

Query was it induced like the Maggot in the Hazel nut to make its escape for want of a convenient situation to change in and how would it have acted enclosed in a tin box.

[*Paper read before the Linnean Society on 2 February* 1790 :]

SOME ACCOUNT OF A MODE OF TAKING THE ANAS FERINA, DUN-BIRD OR EASTERLING AS PRACTISED IN SOME PARTS OF ESSEX.

By William Curtis, F.L.S.

'Tis in the winter season, when the wind blows strongly, and keenly from the East, or North East, that the Dun-birds, or Frenchmen, as they are ludicrously called at Maldon, in company with Wigeon, Duck, various Gulls, and other sea fowl appear on the Essex Coasts. The Dun-birds especially, at some particular seasons arrive in such prodigious numbers, as almost to exceed belief. In the beginning of the winter '86 immediately on the winds changing to the East, and North East, and blowing from thence with uncommon rigour, they appear'd before their usual time in such plenty as the inhabitants never before witnessed ; 1632 were caught at one time in a Dun-bird Decoy at Tolesbury. 'Tis from their arriving chiefly when the wind blows from the East that they probably obtain the name of Easterling, a name by which they are well known in the London Markets.

On the above mention'd coasts within 20 miles of Maldon there are many Decoys, but they do not all catch the same species of Ducks ; some taking Duck and Mallard chiefly as at Braddyl, others Wigeon, Pintail, Teal, Duck and Mallard promiscuously ; but the Dun-birds, which equal if not exceed any other of the Duck tribe, are caught in Decoys, if they may be called by that name, purposely formed on a different principle from those in general use and which are confined chiefly to Goldhanger, Tolesbury and the neighbouring Decoys. As the contrivance has not to our knowledge been noticed by any of our Ornithologists we shall endeavour to give the Society some idea of it

Various reasons unite in making it necessary to catch these birds by themselves ; the principal one however is—they are birds which will not drive, as the Decoy-men term it, but instead of flying up the Pipes or Funnels with Duck, Wigeon and others they either dive or boldly pass by the Decoy-man back into the pond. Another reason is they are fond of tyrranizing over the other ducks and in striving for the mastery of the pond are apt to drive about and molest the more tractable birds, hence the Duck Decoy-men favour their coming as little as possible ; but as these birds are very numerous, highly esteemed and eagerly bought at the London markets, they do not wish to lose so valuable an acquisition as they frequently prove, the catching them in the manner they do being apt to spoil the pond for Duck &c., the proprietors of some of the Decoys have a pond on purpose for taking them in. This Pond, which is called a flight pond, is much larger than a Decoy pond, for these birds flying generally in very large bodies prefer settling on an extensive piece of water. A few pinion'd Dun-birds are all the Decoy ducks necessary in the pond. We may observe that it is only a few times in the season that these birds are attempted to be caught, for as the catching them in the manner we are to relate is attended with considerable noise & disturbance the birds that escape become of course too wary for the catching to be often repeated.

'Tis when an immense number of Dun-birds settle in the pond which is most frequently on their first coming over, when most of them are young and inexperienced and when there is little or no wind, that the catching them is attempted and this is done in the following manner.

Instead of Pipes or Funnels commonly used in Decoy ponds, a very large piece of netting is stretched across and fastened to two very long deal poles or baulks, tapering to the extremity. This, which we call the net and which lies horizontally extended, is render'd capable by a particular apparatus of being suddenly erected. Opposite to where this net is to be raised several persons hid among the trees & bushes which partly encircle the pond suddenly appear shouting and making a noise. The birds on this immediately rise out of the pond & fly from them. Just as they begin to fly the net imperceptible to them from its horizontal situation is put in motion and rising rather slowly becomes perpendicular just as the birds get to it: the birds meeting with so sudden and unexpected an obstacle to their rapid flight fall down into and are caught in large deep bins placed at the base of the nets, from whence they have not the power of extricating themselves. Sometimes two of these upright nets are placed together, and in some ponds there are four of them.

The contrivance for raising the poles to which the nets are affixed is this—each pole near the large end is laid across the top of a square piece of timber with a groove to receive it and in which it is retained by an iron pin. To this end a large box is fixed which is loaded with stones of such a weight as to raise the pole perpendicularly. When loaded it becomes necessary for the small end to be fasten'd down. 'Tis by the loosening of this fastening which is done suddenly by a handspike that the machinery acts; the very superior weight which the great end receives from the stone ballast raising the nets.

Sometimes a few Duck & Mallard are caught with the Dun-birds, but they generally escape. It may be asked why do not the Dun-birds escape also—they undoubtedly would were not their wings uncommonly short, which makes it impossible for them to rise to any considerable height in a short space.

PROCEEDINGS OF THE GENERAL MEETING
7 February 1946

Colonel F. C. Stern, O.B.E., M.C., Vice-President,
in the Chair.

The Proceedings of the General Meeting held on Thursday, 10 January 1946, having been circulated, were taken as read and confirmed.

The following were thanked for gifts made to the Library since the last meeting :—Capt. Eric Hardy, Dr. J. Ramsbottom and the Board for the Netherlands Indies, Surinam and Curaçao.

The following Fellow signed the Obligation in the Roll and Charter Book, and was admitted a Fellow :—Dr. Thomas Edward Tucker Bond.

The Vice-President, in the Chair, reminded Fellows that under Bye-Laws, Chap. 8. Sect. 2, Fellows are entitled to make recommendations for new Members of Council and Officers.

Certificates recommending the election of the following candidates for Associateship were read for the first time,—in favour of Miss Kathryn Benson-Evans, B.Sc., Kenneth John Dormer, Ph.D., B.Sc., and Bernard Verdcourt.

The Vice-President in the Chair reported the deaths of Colonel J. Hamilton Leigh, F.L.S., Sir Cuthbert Cartwright Grundy, Kt., F.L.S. (the Father of the Society, in his 100th year ; a Fellow for seventy-four years) and Major Stanley Smyth Flower, O.B.E., F.L.S. ; and Professor Thomas Hunt Morgan, Foreign Member.

The following communications were read and discussed :—

Mr. J. E. Lousley. A new hybrid *Senecio* (*S. squalidus* L. × *S. viscosus* L.)* from the London area. (Exhibit.) (Discussed by Mr. N. Y. Sandwith, Capt. Cyril Diver, C.B.E., Dr. W. B. Gourlay, Dr. C. Leighton Hare, Dr. R. Melville ; Mr. Lousley replied.)

Description of Exhibit.—

One of the several interesting features of the flora of the London bombed sites is the extraordinary abundance of two *Senecios* which were increasing before the war, though they were then still regarded as local and uncommon.

Senecio squalidus L. is a native of the Central Mediterranean and is known to have been cultivated in Oxford Botanic Gardens since before 1699. Its spread to walls in the town of Oxford and thence to the railway station and along the system of the Great Western Railway has been well described by G. C. Druce (Fl. Oxon. ed. 2, 239 seq., 1927), and in recent years it has become increasingly frequent in London suburbs and especially those on the western side of the metropolis.

Senecio viscosus L. is probably native in some coastal parts of England, and is well distributed throughout Europe though rare in most of the countries bordering on the Mediterranean and apparently absent from the regions in which *S. squalidus* occurs. Although scarce in London until the war it was recorded from Streatham Common by T. Martyn as long ago as 1763 (*Pl. Cantab.*, 98). The occasion was doubtless one of his annual visits to his father, Professor John Martyn, who lived at ' Hill-house '. In 1944 *S. viscosus* occurred associated with *S. squalidus* on the site of a bombed house about a third of a mile from the home of the elder Martyn, and with them was a single large plant which was clearly a hybrid of the two species.

Although the same cross was detected elsewhere in and near London, it was convenient to select this Streatham example as the type for the description I prepared in 1944 for the B.E.C. Report for 1943/4, which should be published shortly. As this paper contains a detailed account of the hybrid, I propose tonight to give only a brief summary with certain information which has come to hand since it was written.

By way of explanation of the exhibits it will suffice to say that it is a larger and more branched plant than *viscosus* and is covered in all its parts with viscid glands, which are less dense than in that species. The ray-florets are narrower than those of *squalidus* and give the flowers a dainty star-like appearance which immediately attracts attention. Other differences are to be found in the phyllaries and in the fruits, although the latter always fail to attain full development.

It is known that hybrids occur rather freely between species of *Senecio*, and one cross which has been recorded for Britain on a number of occasions is that between *S. squalidus* and *S. vulgaris*. Most of the material so-named is somewhat unconvincing owing to the great difficulty in finding satisfactory characters which can be depended upon to separate these two very variable species. In the case of the cross under consideration, there is no such difficulty as there are several good characters in addition to the obvious presence or absence of glands to separate *S. squalidus* and *S. viscosus*. Until recent years these two species have probably never occurred together in quantity and the present case is yet another example of the well known principle that when two closely related species which naturally occupy separate geographical areas are brought into contact hybrids between them are more likely to occur than in the case of two similar species with an overlapping distribution.

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* Subsequently published as × *S. londinensis* Lousley in B.E.C. 1943/4 Rep., 869 seq., April 1946.

In 1944 I observed the new hybrid at Streatham, at three places in the City of London and at Ham, Surrey, and St. Mary Cray, Kent, as already recorded. Unfortunately the type-locality at Streatham was destroyed during the winter of 1944/5 by the construction of temporary houses, and circumstances made it impossible to transfer the root to my garden before it was covered by foundations. At Sergeant's Inn, by the Temple, there were fewer plants of the hybrid in 1945 than in the previous summer, but at Bush Lane, Cannon St., it was observed in the same positions in similar numbers, thus strengthening the impression that it is perennial. Single plants were also seen in new localities in Great Tower St., and Monument St. in the City, but it is evident that the hybrid is much rarer than might be expected from the abundance of both parents.

Outside the London area the new hybrid has been found at Birmingham by Dr. R. C. L. Burges, and I have pleasure in including specimens sent by him in the exhibit. Further search will most probably result in additional localities from other bombed towns.

In conclusion I should like to say that this hybrid was also discovered independently by Mr. N. Y. Sandwith, to whose kind co-operation I am greatly indebted.

Dr. K. STEPHENSEN. Notes of a Terrestrial Amphipod (*Orchestia anomala*) new to Samoa. (Communicated by Dr. Isabella Gordon.) (Discussed by Mr. D. M. Reid; thanks were given to Dr. Stephensen and Dr. I. Gordon.) [Printed in full, below.]

Dr. G. S. CARTER. Wind-tunnel experiments and the flight of the Flying Fish (*Cypsilurus*). (Lt.-Col. W. P. C. Tenison, D.S.O., Dr. Malcolm Smith, Dr. Edward Hindle, F.R.S., and Dr. W. B. Gourlay; Dr. Carter replied.)

Abstract.—

The flight of the Exocoetidae has been discussed for many years, but it was not until recently that observations with the camera and cinematograph and experiments in the wind-tunnel have made it possible to give a consistent account of the flight. Photographs by Edgerton and Breder show clearly the position of the fish and the use it makes of its wings in the flight, and numerous observations by Hubbs have established the average time and length of the glide (2·6 secs. and 40–50 yds.).

Experiments on a fish (*Cypsilurus* sp.) exposed to a current of air in a wind-tunnel showed that the normal glide is not longer than might be expected on accepted aerodynamic principles. But Hubbs also observed occasional abnormally long glides of 10 secs. or more. These are much less easily explained. Some suggestions are put forward for their explanation. The value of the flight to the fish was discussed.

REDESCRIPTION OF ORCHESTIA ANOMALA CHEVREUX, A TERRESTRIAL AMPHIPOD NEW TO SAMOA.

By Dr. K. STEPHENSEN, Zoological Museum, Copenhagen.

(Communicated by Dr. I. Gordon, F.L.S.)

Orchestia anomala CHEVREUX, 1901, p. 393, figs. 8–12.
Orchestia floresiana STEPHENSEN, 1935 *, p. 24, figs. 4–6 (non WEBER).
Orchestia anomala SCHELLENBERG, 1938, p. 65, fig. 65, refs. & synon.

Occurrence.—Malelolelei †, Upolu, Samoa, 21/vi/24. Buxton & Hopkins coll., in very wet forest at 2,000 ft. 1 ♂, 1 ♀.

The present specimens agree fairly well, on the whole, with those described by Chevreux. However, I find that a number of characters have neither been described nor figured by Chevreux, or any subsequent author. I have, therefore, thought it advisable to redescribe and figure the majority of the appendages of the specimens from Samoa.

Description of ♀ with marsupium (*l.*=10 mm.).—The length of the head along the dorsal edge is a trifle shorter than that of the two first segments combined. The eyes are round, black, of moderate size, separated dorsally by a distance equal to half of their diameter. Antenna 1 reaches to the distal end of the penultimate joint of the peduncle of antenna 2 ; the peduncle is nearly twice the length of the flagellum and the three joints are subequal in length ; the flagellum also has three joints, the third being very short. Antenna 2 is as long as the head plus the following four segments ; the peduncle is about as long as the flagellum, and the two distal joints are subequal in length ; the flagellum has 18 joints, each with four stiff setae. Of the oral appendages only the maxillipedes were dissected out ; the palp has a small scale-like fourth joint. Pereiopod 1 has the sideplate ventrally tapering, with a few spines ; the limb is moderately slender, with a few spines ; a pellucid lobe is present only on the fifth joint ; sixth joint about two-thirds the length of the fifth, with the margins almost parallel and with a distinct palm which is half as long as the fingers. Pereiopod 2 has the sideplate with under margin evenly rounded (as also have pereiopods 3 and 4), and a small projection on the posterior margin ; second joint of the limb rather widened above ; fifth to seventh joints each with a pellucid lobe. There is nothing worthy of special mention in pereiopods 3 to 6. Pereiopod 7 has the second joint of the limb finely crenulate on the posterior margin, there are some 28 indentations, each with a setule at the base.

The metasome segments have the posterior edges of the epimeral plates quite smooth. The postero-inferior angle of segment 1 is almost rectangular, armed with a small tooth ; that of segment 2 is the most prominent, having a long process measuring approximately one-fifth of the width of the plate. The tooth on segment 3 is half as long as that on segment 2. Along the ventral margin of epimeral plate 2 (but not on either plate 1 or 2) is a row of vertical fissures very similar to those described on segments 2 and 3 of *Orchestia floresiana* (Stephensen, 1935, p. 26, fig. 5, Barnard, 1935, p. 288, fig. 7) and *Talorchestia ancheidos* (Barnard, 1935, p. 289).

Pleopods 1 and 2 are not much reduced ; the rami are somewhat shorter than the peduncles and furnished with eight or nine pairs of natatory setae.

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* The date on the cover of this part of the volume in the Brit. Museum (Nat. Hist.) library is 1939, but the paper is quoted by Barnard in 1935.—I.G.

† At the same locality a few specimens of *Talitrus hortulanus* Calman (1912, p. 132 ; see also Stephensen, 1943, p. 295) and young specimens of *T. sp.* were also secured. My thanks are due to Dr. Isabella Gordon for sending me these interesting specimens for study. They belong to the British Museum (Nat. Hist.) Colln.

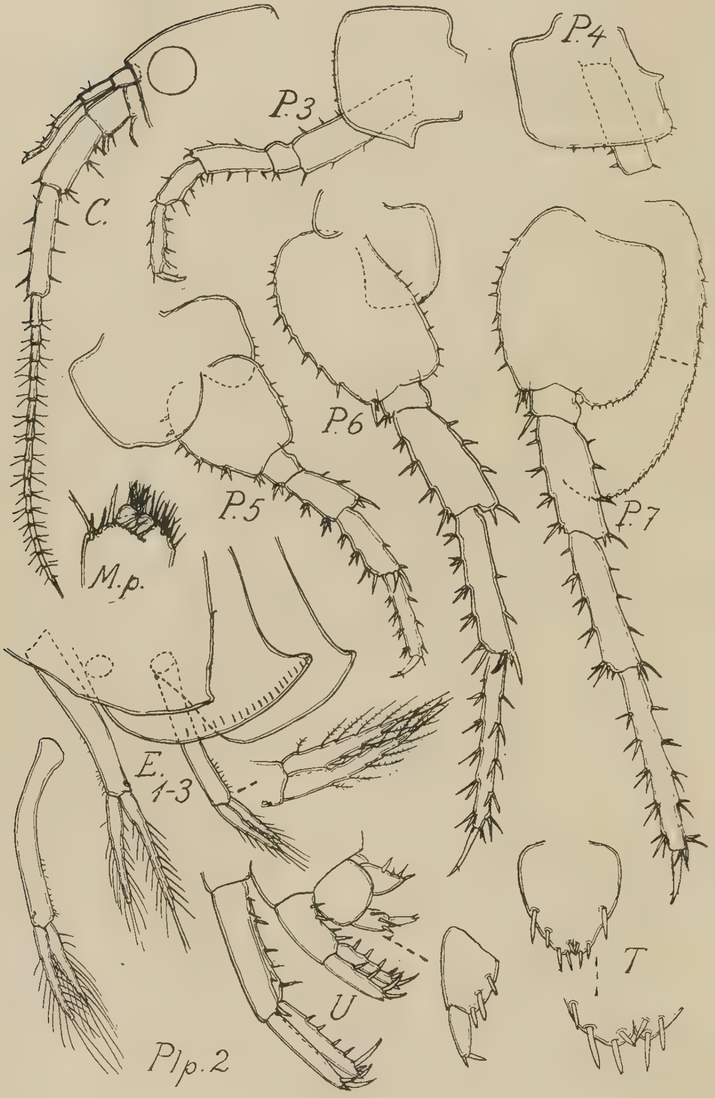

FIG. 1.—*Orchestia anomala* Chevreux, ♀.

C., cephalon, eye and antennae 1 and 2. *E.* 1–3, epimeral plates of metasome segments 1–3, with pleopods 1 and 3. *M.p.*, maxilliped, apex of palp. *P.* 3–7, pereiopods 3–7. *Plp.* 2, pleopod 2. *T.*, telson. *U.*, uropods 1–3 and telson, in lateral aspect.

Pleopod 3 is more reduced, the rami being less than half as long as the peduncle and provided with only five or six pairs of natatory setae. Uropod 1 has the rami a trifle shorter than the peduncle ; each ramus has three apical spines, and the inner has four marginal spines as well. Uropod 2 has the rami subequal in length, and as long as the peduncle ; the outer ramus has two, the inner three or four, marginal spines and each ramus has three apical spines. Uropod 3 has the ramus somewhat shorter than the peduncle and provided with two apical spines, there are three dorsal spines on the peduncle. The telson is oval, with a small distal incision ; there are three pairs of apical spines, and one or two marginal spines on each side.

Description of ♂ (*l.*=10 mm.).—Only pereiopods 1 and 2 were dissected out but, as far as could be ascertained without dissection, all the other limbs agree with those of the ♀. Even the relative lengths of antennae 1 and 2 and the number of joints in the flagella are the same.

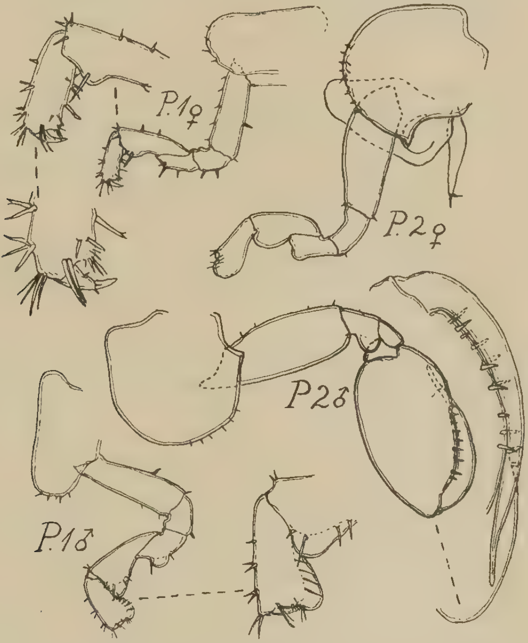

FIG. 2.—*Orchestia anomala* Chevreux.
P. 1–2, pereiopods 1–2, of ♂ and ♀ respectively.

Pereiopod 1 has a bud-like pellucid process on the fourth joint. Pereiopod 2 with second joint not specially wider ; third joint has at the anterior side a lobe much longer than that illustrated by Chevreux (1901, p. 394, fig. 9) ; sixth joint is oblong-oval, the length being nearly twice the breadth ; the palm is half as long as wide with two rows of spines ; the finger is much longer than the palm, nearly as long as the hand, ending in a rather slender, not quite straight, distal part which is concealed in a sort of furrow on the underside of the hand.

Synonymy.—Schellenberg (1936, p. 155) has examined the type-material of *O. floresiana* Weber (1892, p. 262, figs.) and has proved that it is not identical with *O. floresiana* Stephensen 1935. Weber's description is rather brief and is accompanied by only four figures (namely, pereiopods 1 and 2 of male and female) but in 1938 Schellenberg (fig. 33, p. 65) gave a new and better figure of periopod 2 of one of Weber's male cotypes.

In my 1935 paper I have pointed out that *O. floresiana* Stephensen is identical with *O. anomala* Chevreux, 1901 ; therefore the latter name is correct. For further information see Schellenberg 1938, p. 65.

Distribution.—From the Seychelles (type-locality, Chevreux) to the Marquesas ; for special localities see Schellenberg, 1938, p. 66. To these it is necessary to add Samoa.

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PROCEEDINGS OF THE GENERAL MEETING

21 February 1946

Colonel F. C. STERN, O.B.E., M.C., Vice-President,
in the Chair.

The Proceedings of the General Meeting held on Thursday, 7 February 1946, having been circulated, were taken as read and confirmed.

The following were thanked for gifts made to the Library since the last meeting :—Capt. Eric Hardy, Dr. A. J. T. Janse, Prof. F. E. Weiss, Royal University, Uppsala, and the University Tutorial Press, Cambridge.

The following Fellows signed the Obligation in the Roll and Charter Book, and were admitted Fellows :—The Lord Rothschild, G.M., Ph.D., and John Gregory Hawkes, M.A., Ph.D.

A certificate recommending the election of the following candidate for Associateship was read for the first time,—in favour of Anthony Johnston, B.Sc.

The following were elected Associates,—Miss Kathryn Benson-Evans, B.Sc., Kenneth John Dormer, Ph.D., B.Sc., and Bernard Verdcourt.

The Vice-President in the Chair, reported the death of Professor Thomas Barbour, Foreign Member.

The following communications were read and discussed :—

Mr. M. CÁRDENAS and Dr. J. G. HAWKES. New and little known wild potato species from Bolivia and Peru. (Read by Dr. J. G. Hawkes ; and discussed by Mr. A. H. G. Alston, Dr. E. M. Delf ; Dr. Hawkes replied.) [Printed in full in Journal, Botany, no. 349].

Major D. ETHERINGTON Malaria in Italy. (Discussed by Dr. Malcolm Smith, Dr. B. Barnes, Mr. I. H. Burkill, Dr. W. B. Turrill ; Major Etherington replied.)

Abstract.—

The history of malaria in Italy—the relation between agricultural development and malaria—the distribution of malaria during this century. The

distribution of Anopheline species in Italy ; the conception of mosquito varieties —habits distinguishing varieties—the determination of the varieties. The effects of the war—the present position ; measures taken to combat malaraia ; the outlook for the future.

Dr. B. BARNES. Floral abnormalities in *Stellaria* and *Anagallis*. (Discussed by Dr. K. J. Dormer, Mr. A. H. G. Alston, Mr. I. H. Burkill, Dr. M. A. Brett, Mr. F. C. Grigg, Dr. W. B. Turrill and Mr. W. C. Wordsell ; Dr. Barnes replied.) [To be printed in full in Journal, Botany.]

Abstract.—

Chickweed, *Stellaria media* Vill. and scarlet pimpernel, *Anagallis arvensis* L. produce, not infrequently, flowers which show a mixture of vegetative and floral characters. A provisional account will be given of some of these flowers which have been found in chickweed, and a brief reference will be made to similar flowers of the scarlet pimpernel. It is not yet possible to suggest a satisfactory explanation of the causes which bring about the abnormalities.

Discussion.—

Dr. K. J. DORMER asked for information as to the vascular anatomy of the abnormal flowers described by Dr. Barnes.

Mr. A. G. H. ALSTON said that Dr. Barnes's figures of the epidermis of the normal flowers of chickweed showed no stomata, while those of the modified petals had stomata. He thought that this provided the explanation of the nature of the change which had taken place. The damage to the plant reduced its area of transpiration and the transformation of reproductive tissues into vegetative represented an attempt to re-adjust its metabolism and not a genetical change.

Mr. I. H. BURKILL commented on the interest of the persistence of the free central placenta although the carpellary wall had been changed into an elongated tube.

Dr. M. A. BRETT asked how many stamens were present in the abnormal flowers of *Stellaria media* which Dr. Barnes described, it being well known that the species is subject to some variation in stamen number.

Mr. F. C. GRIGG referred to the narrow transition of tissues within 3–10 cells found in floral parts of fasciated *Digitalis purpurea* and *Sempervivum persicum* (Juvenile form) ; also similar change over 2–5 cells noticed in epidermis of the three transitional leaves of the original adult rosette that produced the adult form of the latter.

Dr. W. B. TURRILL asked if the abnormalities could not have some genetic basis. Mr. Marsden-Jones and he had found abnormalities in *Saxifraga granulata* which were morphologically not dissimilar from those described for *Stellaria media* and which had a genetic basis.

Mr. W. C. WORSDELL remarked that the varying conditions of cultivated soil under which Chickweed and Scarlet Pimpernel often grow in fields and gardens, might have something to do with their abnormal structures.

He thought that there might be a good deal that was new in Dr Barnes's observations. In Penzig's ' Teratology ' there is no mention of the abnormal structures in *Stellaria media*.

The transitions in the epidermal structure as between the normal foliage leaf of *Stellaria* and the leafy petal are particularly interesting.

Dr. BARNES replied.

The following paper was read in title :—

' New or interesting Tropical Fungi.—I.' By C. G. HANSFORD, M.A., F.L.S.

NEW OR INTERESTING TROPICAL FUNGI.—1.

By C. G. HANSFORD, M.A., F.L.S.,
Plant Pathologist, Department of Agriculture, Uganda.

The fungi recorded in this paper have in part been collected by the author in Uganda, while the remainder have been found in collections received for determination from the Belgian Congo, Kenya, India and Ceylon.

MYRIANGIACEAE.

1. **Molleriella Microglossae** Hansf., sp. n.

Ascomata epiphylla, in pilis folii parasitica, laxe dispersa, singula, plerumque terminalia, interdum lateralia, brunnea vel lutea, irregulariter subglobosa vel subdiscoidea, sublobata, usque ad 100 μ diam. et 70 μ alt., levia, glabra, in maturitate pallidescentia, deorsum in stipitem brevem contracta et in pilo folii in mycelio hyalino dissoluta ; paries unistratosus parenchymaticus, ex cellulis angulosis 8–12 μ diam. compositus, in maturitate mucoso-dissolvens. *Asci* irregulariter unistratosi, aparaphysati, subglobosi, subsessiles, sursum late rotundati incrassati (—4 μ), maturi circa 30 × 25 μ, 8-spori. *Sporae* oblongae utrinque rotundatae, hyalinae, leves, medio 1-septatae, leniter constrictae, 13–15 × 6–7 μ, cellula superiore lenissime crassiore, in maturitate 3-septatae et dubie muriformes.

Hab. in foliis *Microglossae volubilis*, Entebbe Road, Uganda, *Hansford 3627 p.p.*

The ascomata are scattered loosely on single leaf-hairs on the upper side of the host leaf, usually single on each leaf-hair and terminal, occasionally lateral, attached by a short stalk-like portion closely adnate to the leaf-hair and composed of small dark parenchyma in a single layer, penetrating the cell-wall of the host and passing into a loose hyaline internal mycelium, very indistinct and closely adnate to the cell-walls of the leaf-hair. The ascomata are brown to yellow-brown, irregularly globose to subdiscoid, often more or less lobed and then with each lobe containing a single ascus. The wall of the ascoma consists of a single layer of brown angular parenchyma, which at maturity separates into single cells floating on a gelatinous ground substance and enclosing a group of asci arranged in a single irregular layer. At first the asci are separated by narrow bands of a few gelatinous hyaline cells which soon disappear. The asci are subglobose, broadly rounded and somewhat thickened around the apex, constricted below into a very short nodose stipe, with a wall of two layers ; the conglobate group of eight spores can be squeezed out of the ascus still surrounded by the intact inner ascus wall. The spores are at first 1-septate and slightly constricted in the middle, but later become 1-septate and doubtfully muriform ; ripe spores are strongly refractive.

2. **Molleriella Erlangeae** Hansf., sp. n.

Ascomata hypophylla, irregulariter singulariterque dispersa, in pilis folii parasitica, terminalia vel plerumque lateralia, sessiles vel dubie stipitata, deorsum in pilo folii in hyphis paucis hyalinis dissoluta ; ascomata dilute brunnea, pallidescentia, irregulariter discoidea vel subglobosa, levia, usque ad 150 μ diam. et 60–90 μ alt. ; paries unistratosus, ex cellulis angulosis 6–10 μ diam. et circa 6 μ cr. compositus, in maturitate cellulis secedentibus et in muco hyalino natentibus. *Asci* irregulariter unistratosi, aparaphysati, subglobosi, deorsum leniter contracti et interdum nodoso-stipitati, sursum late rotundati incrassatique (—6 μ), 8-spori, 30–35 × 30 μ. *Sporae* irregulariter 3-seriatae vel conglobatae, oblongae, utrinque rotundatae, hyalinae, rectae vel curvulae, leves, transverse 3-septatae, haud constrictae 15–20 × 7 μ.

Hab. in foliis *Erlangeae tomentosae*, Entebbe Road, Uganda, *Hansford 3656*.
The structure of the ascoma of this species very closely resembles that of the preceding.

3. **Leptophyma Microglossae** Hansf., sp. n.

Ascomata hypophylla, laxe irregulariterque dispersa, superficialia, dilute brunnea, in maturitate pallidescentia, 120–180 μ diam., 60–80 μ alta, levia, irregulariter discoidea, margine sublobulata. *Mycelium* superficiale, ex hyphis hyalinis flexuosis irregulariter ramosis, 2–3 μ crassis, laxissime reticulatis, exhyphopodiatis compositum. *Setae myceliales* paucae, juxta perithecia evolutae, erectae, rectae vel leniter sinuosae, simplices, obtusae, atrae, septatae, usque ad 140 × 3–4 μ. *Paries ascomatis* unistratosus, ex hyphis flexuosis, intertextis, dilute brunneis, dense septatis, 3–4 μ crassis compositus, in maturitate mucoso-diffluens. *Asci* in strato uno irregulariter dispositi, aparaphysati, subglobosi vel late clavati, subsessiles, sursum rotundati, interdum leniter incrassati, 8-spori, maturi circa 40 × 30 μ. *Sporae* conglobatae, ellipsoideae, utrinque rotundatae, hyalinae, refringentes, leves, 1-septatae, haud vel lenissime constrictae, cellula superiore leniter crassiore, 17–20 × 6–8 μ, in maturitate utrinque saepe subapiculatae.

Hab. in foliis *Microglossae volubilis*, Entebbe Road, Uganda, *Hansford 3627 p.p.*

Apparently this fungus is saprophytic on the lower surface of the host leaf, with a superficial loose hyaline mycelium not penetrating the stomata and without hyphopodia. Around the ascomata from 0–6 erect dark, more or less straight, simple, obtuse setae arise from the mycelium. The ascomata are loosely and irregularly scattered amongst the leaf-hairs and measure up to 180 μ diam. by 80 μ high, irregularly discoid on a wide base, somewhat lobulate around the margin, smooth, pale brown, becoming paler when fully mature. The wall consists of a single layer of brown hyphae, flexuous and loosely interwoven, divided into short cells but not giving a true parenchymatous appearance ; later the cells separate and float on the surface of a tough mass of structureless hyaline to yellowish mucus enclosing the asci. Asci numerous, up to 30 or more, arranged in an irregular single basal layer, aparaphysate, subglobose to broadly clavate, subsessile, 8-spored. Spores conglobate, ellipsoid with rounded ends, hyaline and very refractive, smooth, 1-septate, scarcely constricted, the upper cell very slightly wider than the lower ; when fully mature the spores are often more or less apiculate at each end.

The systematic position of this fungus is rather obscure, as it could easily be considered as an aberrant Discomycete allied to the Agyriaceae of Clements and Shear ; on the other hand, the very refractive spores in our opinion show affinity to those of many Myriangiaceae.

DOTHIDEACEAE.

4. **Trichodothis Ocoteae** Hansf., sp. n.

Stromata amphigena, plerumque hypophylla, atra, dura, plus minusve discoidea vel depresso-pulvinata, irregulariter dispersa, singula vel 2–3-connata, usque ad 800 μ diam. et 100–140 μ alt., sursum plus minusve rugulosa, basi centraliter in folio affixa, contextu prosenchymatico ex cellulis atris angulosis 8–18 × 3–7 μ composito, sub epidermidem folii penetrante et in mesophyllo in hyphis intercellularibus hyalinis septatis dissoluto, interdum sub epidermidem superiorem folii hypostroma atrum minutum efformantibus. *Loculi* irregulariter concentrice circum medium sterilem dispositi, globosi vel ampullacei, immersi, usque ad 150 μ diam. et ad 100 μ alt., sursum in poro rotundato haud prominenti attenuati ; paries 2-stratosus, parenchymaticus, hyalinus, indistinctus, 3–5 μ crassus. *Asci* basales, aparaphysati, plerumque curvuli, subsessiles, sursum rotundati haud incrassati, 8-spori, 60–90 × 12–15 μ. *Sporae* anguste ellipsoideae utrinque rotundatae, 1-septatae, haud vel lenissime constrictae, 23–28 × 5 μ, subrectae, 2-seriatae, cellulis subaequalibus, leves, olivascentes.

Ascostromata hyphis radiantibus numerosis, atrobrunneis, septatis, simplicibus, flexuosis, exhyphopodiatis superficialibus, obtusis, usque ad 200 × 4–5 μ circumdata.

Hab. in foliis *Ocoteae usambarensis*, Kivu, Congo Belge, *F. L. Hendrickx 2484.*

The stromata are amphigenous, but mostly hypophyllous, black, hard, more or less circular, discoid to flattened pulvinate, single or 2–3-connate, scattered irregularly, each centrally attached to a hypostroma in the leaf, the external stroma consisting of a sterile centre surrounded by irregularly concentric rings of loculi occupying most of the upper surface and giving this a more or less rugulose appearance, but the ostioles not projecting. The stroma tissue consists of black angular cells, thin to thick-walled, in the lower part rather elongated and radiating from the central attachment, in the remainder of the stroma of irregular shape and size. Around the edge of the stroma the surface cells extend into dark brown hyphae radiating irregularly over the leaf, septate, more or less flexuous, simple, obtuse, not penetrating the leaf nor producing hyphopodia. The loculi are completely immersed in the stroma and each is lined with an indistinct wall of 2–3 layers of hyaline compressed parenchyma, pierced at the apex by a round or irregular pore about 10 μ diam.

The internal stroma is continuous at the point of attachment with the tissue of the external ascostroma, but below the epidermis it dissolves into loose hyaline intercellular hyphae penetrating the whole mesophyll, and often aggregated beneath the opposite epidermis into a small black hypostroma, though very rarely producing any external stroma on this side of the leaf. No haustoria are formed in the mesophyll.

MELIOLACEAE.

5. **Schiffnerula Entandrophragmae** Hansf., sp. n.

Plagulae epiphyllae, griseo-atrae, tenues vel densae, usque ad 3 mm. diam., leves. *Mycelium* ex hyphis dilute brunneis, rectis vel leniter flexuosis, 6–8 μ cr., irregulariter ramosis, laxe vel dense reticulatis, septatis (cellulis plerumque 25–30 μ longis) compositum. *Hyphopodia* continua, alternata vel unilateralia, hemisphaerica, integra 10–12 × 6–7 μ. *Conidia* biformia :—(*a*) sarcineliformia, numerosissima, in hyphis sessilia, irregulariter globosa, atrobrunnea, levia vel asperulata, muriformia, 30–35 μ diam. ; (*b*) helminthosporioidea, pauca, fusoidea, curvula, dilute brunnea, levia, 35–42 × 12–13 μ, 3-septata, haud vel lenissime constricta. *Perithecia* in centro plagularum dense disposita, subglobosa, primo brunnea, demum pallidescentia, 50–70 μ diam. et 40–50 μ alt., sessiles ; paries unistratosus ex cellulis angulosis 8–10 μ diam. compositus, in maturitate mucoso-dissolvens. *Asci* aparaphysati, 2–4, in successione maturescentes, subglobosi, sessiles, 35–45 μ diam., 8-spori. *Sporae* conglobatae, oblongae utrinque rotundatae, 1-septatae, leniter constrictae, leves, 23–28 × 11–13 μ, cellula superiore leniter majore, primo hyalinae, in maturitate dilute brunneae.

Hab. in foliis *Entandrophragmae angolensis*, Mitalla Maria, Masaka Road, Uganda, *Hansford 3675.*

The fungus is a typical *Schiffnerula*, producing both usual conidial forms ; it was found on young seedlings of *Entandrophragma* in a forest nursery.

6. **Irenina Agauriae** Hansf., sp. n.

Plagulae epiphyllae, atrae, leves, orbiculares, densae, usque ad 2 mm. diam. *Mycelium* ex hyphis subrectis vel leniter flexuosis, atrobrunneis, 7·5–10 μ crassis, septatis (cellulis plerumque 20–30 μ longis), opposite ramosis (45–60°), dense reticulatis compositum. *Hyphopodia capitata* alternata, suberecta vel plus minusve antrorsa, recta vel curvula, 16–26 μ longa ; cellula basali cylindracea, 5–10 μ longa, cellula apicali subglobosa vel clavata, integra vel interdum leniter angulosa, 11–18 × 10–13 μ. *Hyphopodia mucronata* plerumque in hyphis distinctis evoluta, plerumque opposita, ampullacea, 20–28 × 10–12 μ, collo curvato 4–5 μ cr., interdum dense disposita et raro ternata. *Setae myceliales* nullae. *Perithecia* laxe dispersa vel singula, atra, globosa, usque ad 280 μ diam., cellulis parietis obtuse conoideis aut non fere prominentibus, setis nullis, deorsum hyphis radiantibus descendentibus circumdata. *Sporae* atrobrunneae, ellipsoideae vel subfusiformes, utrinque attenuato-rotundatae, plus minusve curvatae, 3-septatae, constrictae 50–58 × 17–20 μ (av. 54 × 19 μ).

Hab. in foliis *Agauriae salicifoliae*, Mt. Biega, Kivu, Congo Belge, *F. L. Hendrickx 2538.*

The mature perithecia, often single in the centre of each colony, are often elevated slightly above the leaf on the radiating hyphae extending outwards from the basal wall cells and are very easily detached ; no true perithecial setae are present and the wall cells scarcely project from the general surface.

7. **Irenina myricicola** Hansf., sp. n.

Plagulae amphigenae, plerumque epiphyllae, atrae, leves, usque ad 1 mm. diam., vel numerosae confluentesque. *Mycelium* in epiphyllo ex hyphis rectis, in hypophyllo ex hyphis flexuosis, atrobrunneis, 7–8·5 μ cr. (cellulis plerumque 15–20 μ longis), dense opposite (45–60°) ramosis, dense reticulatis compositum. *Hyphopodia capitata* alternata (rarissime opposita), leniter antrorsa, plerumque recta, 14–20 μ longa, cellula basali cylindracea 4–9 μ longa, cellula apicali clavata integraque vel plerumque sub-2—3-lobata vel angulosa, 10–14 × 8–14 μ. *Hyphopodia mucronata* pauca, dispersa, plerumque alternata, ampullacea, 15–20 × 8–9 μ, collo brevi 4 μ cr. *Setae myceliales* nullae. *Perithecia* dispersa vel singula, atra, globosa, usque ad 360 μ diam., cellulis parietis mammillatis vel conoideis, usque ad 23 μ alt. *Sporae* atrobrunneae, cylindraceae, utrinque rotundatae, 3-septatae, constrictae, 46–55 × 13–17 μ (av. 50 × 15 μ),plerumque curvulae.

Hab. in foliis *Myricae* spec. indet., Mt. Biega, Kivu, Congo Belge, *F. L. Hendrickx 2524.*

8. **Meliola Anthospermi** Hansf., sp. n.

Plagulae epiphyllae, interdum etiam hypopyllae, atrae, 1 mm. diam. vel confluentes, tenues vel subdensae. *Mycelium* ex hyphis atrobrunneis, subrectis vel leniter sinuosis, 7·5–10 μ crassis (cellulis plerumque 20–25 μ longis), opposite vel irregulariter ramosis (45–90°), laxe vel subdense reticulatis compositum. *Hyphopodia capitata* alternata, plus minusve antrorsa, plerumque recta, 21–27 μ longa, cellula basali cuneata, 5–10 μ longa, cellula apicali clavata, integra, apice late rotundata, 13–18 × 10–14 μ. *Hyphopodia mucronata* in hyphis distinctis evoluta, ampullacea 15–20 × 7–8 μ, collo brevi 3–4 μ crasso. *Setae myceliales* dispersae, erectae, rectae, simplices, acutae, usque ad 420 × 9 μ. *Perithecia* dispersa, atra, globosa, leniter verrucosa, usque ad 205 μ diam. *Sporae* atrobrunneae, cylindraceae vel subellipsoideae, utrinque rotundatae, 4-septatae, leniter constrictae, 37–45 × 15–20 × 11–14 μ (40 × 17·5 μ).

Hab. in foliis *Anthospermi* spec. indet., Mt. Biega, Kivu, Congo Belge, *F. L. Hendrickx 2518* (typus) ; loc. cit., *Hendricx 2541.*

9. **Meliola bambusicola** Hansf., sp. n.

Plagulae epiphyllae, rarius etiam hypophyllae, atrae, densae, velutinae, orbiculares, usque ad 3 mm. diam., laxe dispersae. *Mycelium* ex hyphis atrobrunneis, sinuosis, 7–9 μ crassis, (cellulis plerumque 15–20 μ longis), alternatim vel irregulariter ramosis, dense reticulatis compositum. *Hyphopodia capitata* alternata, plus minusve antrorsa, recta vel curvata, 19–35 μ longa, cellula basali cylindracea, 5–12 μ longa, cellula apicali versiformi, plus minusve fortiter 2—6-lobata, 13–24 × 10–20 μ. *Hyphopodia mucronata* in hyphis distinctis evoluta, opposita vel alternata, breviter ampullacea, 15–20 × 8–10 μ. *Setae myceliales* numerosae, dispersae, erectae, atrae, rectae, 200–250 μ alt., 10–12 μ cr., sursum 2—3-dichotomae, ramulis late divergentibus, primariis 20–80 μ longis, secondariis —50 μ, tertiariis —20 μ, acutis. *Perithecia* dispersa, atra, globosa, verrucosa, 180–230 μ diam. *Sporae* atrobrunneae, cylindraceae, vel ellipsoideae, utrinque rotundatae, 4-septatae, constrictae, 48–55 × 18–21 μ (av. 52 × 19·5 μ).

Hab. in foliis *Bambusae* spec., Ooty, South India, leg. *P. V. Somayajulu*, 23.2.1923 ; typus in Herb. Coimbatore, India.

10. **Meliola Begoniae** Hansf., sp. n.

Plagulae amphigenae, dispersae, atrae, minutae, 0·2–0·5 mm. diam., tenues. *Mycelium* ex hyphis atrobrunneis, sinuosis, 7–8 μ crassis, (cellulis plerumque 15–25 μ longis), alternatim vel unilateraliter ramosis, laxe vel subdense reticulatis compositum. *Hyphopodia capitata* alternata, plus minusve antrorsa, 16–21 μ longa, cellula basali cylindracea, 2–7 μ longa, cellula apicali subintegra, angulosa vel sub-3-lobata, recta vel curvula, 10–16 × 10–14 μ. *Hyphopodia mucronata* plerumque in hyphis distinctis evoluta, opposita, ampullacea 13–20 × 7–9 μ, collo curvato 2–3 μ crasso. *Setae myceliales* dense dispersae et juxta perithecia evolutae, erectae, atrae, rectae, simplices, acutae, usque ad 380 × 7–8 μ. *Perithecia* in centro plagularum dense aggregata, atra, globosa, verrucosa, usque ad 180 μ diam. *Sporae* atrobrunneae, cylindraceae, utrinque rotundatae, 4-septatae, leniter constrictae, 32–41 × 13–16 μ (37 × 14 μ).

Hab. in foliis *Begoniae Meyeri-johannis*, Luiri Falls, Mt. Kahuzi, Kivu, Congo Belge, *Hansford 3578* ; loc. cit., *F. L. Hendrickx* ***2544, 2559*** (typus).

This is the first species to be recorded on Begoniaceae, and the minute colonies are easily missed. Hitherto it has not been found outside the type-locality.

11. **Meliola Hypoestis** Hansf., sp. n.

Plagulae epiphyllae, atrae, 0·5 mm. diam., densae. *Mycelium* ex hyphis atrobrunneis, sinuosis, 7–9 μ crassis, (cellulis plerumque 15–25 μ longis), alternatim vel unilateraliter ramosis, dense reticulatis compositum. *Hyphopodia capitata* alternata, plus minusve antrorsa, recta vel curvula, 20–27 μ longa, cellula basali cylindracea vel cuneata, 6–11 μ longa, cellula apicali clavata, late ovata vel saepe 2–3-sublobulata, plus minusve anguloso-irregulari, raro integra, 13–20 × 9–17 μ. *Hyphopodia mucronata* pauca, dispersa, ampullacea, curvata. *Setae myceliales* dispersae, erectae, atrae, rectae, simplices vel raro 2-dentatae (—10 μ) acutae, 220–320 × 7–9 μ. *Perithecia* in centro plagularum dense aggregata, globosa, atra, verrucosa, usque ad 240 μ diam. *Sporae* atrobrunneae, cylindraceae, utrinque rotundatae, 4-septatae, constrictae, 32–37 × 13–15 μ (av. 35 × 14 μ).

Hab. in foliis *Hypoestis verticillaris*, Mt. Kahuzi, Kivu, Congo Belge, *Hansford 3573 p.p.*

In this collection this species occurs mixed with *M. acanthacearum* Hansf., from which it is easily distinguished by the characters of mycelium and hyphopodia.

12. **Meliola karamojensis** Hansf., sp. n.

Plagulae amphigenae, atrae, orbiculares, densae, usque ad 1 mm. diam. *Mycelium* ex hyphis atrobrunneis, subrectis, 7–9 μ crassis, (cellulis plerumque 20–30 μ longis), alternatim vel irregulariter ramosis, dense radianto-reticulatis compositum, in centro plagularum subsolidum. *Hyphopodia capitata* alternata, plus minusve antrorsa, 25–32 μ longa, cellula apicali ovata vel clavata, rotundata, integra 12–18×10–13 μ. *Hyphopodia mucronata* non visa. *Setae myceliales* paucae, praecipue juxta perithecia evolutae, erectae, rectae, atrae, usque ad 250×7–9 μ, apice simplices, subacutae. *Perithecia* dispersa, atra, globosa, verrucosa, usque ad 140 μ diam. *Sporae* atrobrunneae, cylindraceae vel subellipsoideae, utrinque rotundatae, 4-septatae, fortiter constrictae, 38–42×13–16 μ, cellula media majore.

Hab. in foliis *Osyridis abyssinicae*, Karamoja, Uganda, *Hansford 2687* ex *A. S. Thomas 3292*.

13. **Meliola Maesopsidis** Hansf., sp. n.

Plagulae epiphyllae, atrae, tenues, orbiculares, usque ad 3 mm. diam. *Mycelium* ex hyphis atrobrunneis, subrectis vel leniter sinuosis, 6 μ crassis, (cellulis plerumque 15–20 μ longis), opposite ramosis (45–60°), subdense vel laxe reticulatis compositum. *Hyphopodia capitata* alternata, leniter antrorsa, plerumque recta, 12–19 μ longa, cellula basali cylindracea, 3–6 μ longa, cellula apicali cylindracea vel clavata, apice rotundata, integra 9–13×6–8 μ. *Hyphopodia mucronata* dispersa, opposita vel plerumque alternata, conoideo-ampullacea, 15–20×7–8 μ, collo brevi 3–4 μ crasso. *Setae myceliales* plerumque juxta perithecia evolutae, etiam in mycelio laxe dispersae, erectae, atrae, rectae, usque ad 220×7–8 μ cr., apice plerumque 2–4-dentatae (—12 μ), raro simplices acutae. *Perithecia* laxe dispersa, atra, globosa, verrucosa, usque ad 190 μ diam. *Sporae* atrobrunneae, cylindraceae, utrinque rotundatae, 4-septatae, constrictae, 33–39×13–16 μ.

Hab. in foliis *Maesopsidis eminii*, Kisubi, Entebbe Road, Uganda, *Hansford 3662*.

14. **Meliola kisubiensis** Hansf., sp. n.

Plagulae epiphyllae, atrae, densae, subcrustosae, orbiculares, 1–2 mm. diam. *Mycelium* ex hyphis atrobrunneis, subrectis vel leniter flexuosis, 8–11 μ crassis (cellulis plerumque 15–20 μ longis), opposite ramosis (45–60°), dense reticulatis compositum. *Hyphopodia capitata* alternata, plus minusve antrorsa, recta vel curvula, 21–30 μ longa, cellula basali cylindracea, 5–11 μ longa, cellula apicali cylindraceo-clavata, recta vel curvula, integra vel tenuiter 2–3-lobata, 15–21×11–14 μ. *Hyphopodia mucronata* pauca vel numerosa, dense disposita, opposita vel alternata, ampullacea, 18–27×7–10 μ, collo elongato 3 μ crasso. *Setae myceliales* juxta perithecia et in mycelio laxe dispersae, erectae, atrae, rectae, simplices, subacutae, 500–640 μ×9–12μ. *Perithecia* dispersa, atra, globosa, usque ad 270 μ diam., cellulis parietis obtuse conoideis vel mammillati, usque ad 18 μ alt, *Sporae* ellipsoideae, utrinque rotundatae, constrictae, 4-septatae, 50–57×22–27 μ (av. 53×24 μ).

Hab. in foliis *Toddaliae asiaticae*, Kisubi, Entebbe Road, Uganda, *Hansford 3645 p.p.*

The very small dense and subcrustose colonies are rather strongly parasitic and cause slight raising of the leaf tissues below them and some yellowish discoloration.

15. **Meliola Micheliae** Hansf., sp. n.

Plagulae hypophyllae, atrae, densae, velutinae, orbiculares, usque ad 5 mm. diam. *Mycelium* ex hyphis atrobrunneis, flexuosis, 6–9 μ, crassis (cellulis plerumque 15–25 μ longis), opposite vel irregulariter ramosis (60–90°), dense reticulatis compositum. *Hyphopodia capitata* alternata, 17–25 μ longa, cellula basali cylindracea, 3–9 μ longa, cellula apicali cylindraceo-clavata, recta vel curvula, integra, 12–19×8–11 μ. *Hyphopodia mucronata* dispersa, alternata vel unilateralia, curvato-ampullacea, 15–22×7–9 μ. *Setae myceliales* numerosae, dispersae, erectae, rectae vel leniter flexuosae, atrae, simplices, subacutae, 350–550×7–10 μ. *Perithecia* dispersa, atra, globosa, verrucosa, 130–160 μ diam. *Sporae* atrobrunneae, cylindraceae vel subellipsoideae, utrinque rotundatae, 4-septatae, constrictae, 43–47×18–22 μ (av. 45×21 μ).

Hab. in foliis *Micheliae fuscatae*, Badulla, Ceylon, 1917, Herb. Peradeniya *s.n.*

16. **Meliola ngongensis** Hansf., sp. n.

Plagulae epiphyllae, orbiculares, atrae, subdensae, velutinae, usque ad 3 mm. diam. *Mycelium* ex hyphis atrobrunneis, subrectis vel sinuoso-flexuosis, 8–10 μ crassis (cellulis plerumque 30–40 μ longis), opposite ramosis (45–60°), dense reticulatis compositum. *Hyphopodia capitata* alternata, suberecta, plus minusve curvata, 25–33 μ longa, cellula basali cylindracea vel cuneata, 4–9 μ longa, cellula apicali varie curvata, cylindracea, apice rotundata vel sinuoso-sublobata, 19–27×10–16 μ. *Hyphopodia mucronata* dispersa, opposita vel alternata, conoideo-ampullacea, plus minusve curvata, 20–28×7–9 μ, collo 4–5 μ crasso. *Setae myceliales* numerosae, dense dispersae et juxta perithecia evolutae, erectae, rectae, atrae, simplices, obtusae, 260–440×9–10 μ. *Perithecia* dispersa, atra, globosa, verrucosa, usque ad 200 μ diam. *Sporae* atrobrunneae, cylindraceae, utrinque rotundatae, 4-septatae, constrictae 46–53×18–22 μ (49×20 μ).

Hab. in foliis *Jasmini* spec., Ngong Hills, Nairobi, Kenya, *F. L. Hendrickx 2565.*

17. **Meliola osyridicola** Hansf., sp. n.

Plagulae amphigenae et caulicolae, dispersae, atrae, densae velutinae, subcrustosae, orbiculares, usque ad 1 mm. diam. *Mycelium* ex hyphis atrobrunneis, subrectis vel leniter undulatis, 7–10 μ crassis (cellulis plerumque 15–20 μ longis), opposite ramosis (45–90°), dense reticulatis compositum, in centro plagularum subsolidum. *Hyphopodia capitata* alternata, antrorsa, recta vel curvula, 18–30 μ longa, cellula basali cylindracea, 6–14 μ longa, cellula apicali ovata vel clavata, rotundata, integra, 13–17×9–12 μ. *Hyphopodia mucronata* non visa. *Setae myceliales* numerosae, dense dispersae, etiam juxta perithecia aggregatae, erectae, atrae, rectae, simplices, 180–240×8–9 μ, apice obtusae vel subacutae. *Perithecia* in centro plagularum dense aggregata, atra, globosa, verrucosa, 170–230 μ diam. *Sporae* atrobrunneae, cylindraceae vel subellipsoideae, utrinque rotundatae, 4-septatae, constrictae, 44–53×16–21 μ (48·5×18·5 μ).

Hab. in foliis *Osyridis arboreae*, Ooty, South India, 14.iii.1937, leg. *Krishnaswamy* (typus in Herb. Coimbatore).

18. **Meliola Petchii** Hansf., sp. n.

Plagulae amphigenae, atrae, usque ad 5 mm. diam. vel numerosae confluentesque, tenuiter velutinae. *Mycelium* ex hyphis atrobrunneis, subrectis, 6–7 μ crassis (cellulis plerumque 20–30 μ longis), opposite ramosis (30–45°), laxe vel subdense reticulatis compositum. *Hyphopodia capitata* alternata, plus minusve antrorsa, recta vel curvula, 18–25 μ longa, cellula basali cylindracea 4–9 μ longa, cellula apicali cylindreaceo-clavata, integra, 12–17×7–10 μ. *Hyphopodia mucronata* pauca, dispersa, opposita vel alternata, conoideo-ampullacea, recta vel curvata, 15–22×7–8 μ, praecipue in centro plagularum evoluta. *Setae myceliales* numerosae, dispersae, erectae, rectae, atrae, simplices, acutae, 200–280×7–8 μ. *Perithecia* dispersa, atra, globosa, verrucosa, 110–140 μ diam. *Sporae* atrobrunneae, cylindraceae, utrinque rotundatae, 4-septatae, constrictae, 32–38×12–15 μ (av. 35×14 μ).

Hab. in foliis *Strychni nux-vomicae*, Peradeniya, Ceylon, 21. xii. 1921, *Herb. Peradeniya 6518.*

19. **Meliola Ranganathii** Hansf., sp. n.

Plagulae amphigenae, atrae, numerosae et subconfluentes, 1–3 mm. diam. *Mycelium* ex hyphis atrobrunneis, subrectis vel leniter flexuosis, 6–8 μ crassis (cellulis plerumque 10–15 μ longis), opposite ramosis (60–90°), dense reticulatis compositum. *Hyphopodia capitata* alternata, recta vel curvula, 13–22 μ longa, leniter antrorsa, cellula basali cylindracea, 4–8 μ longa, cellula apicali cylindracea, apice rotundata, interdum clavata, 10–18 × 7–10 μ. *Hyphopodia mucronata* pauca, dispersa, opposita vel alternate, conoidea, recta vel curvata, 14–18 × 6–9 μ. *Setae myceliales* paucae, dispersae, erectae, atrae, rectae, simplices, acutae, 200–340 × 7–8 μ. *Perithecia* dispersa, atra, globosa, verrucosa, 130–170 μ diam. *Sporae* atrobrunneae, cylindraceae, utrinque rotundatae, 4-septatae, constrictae, 35–42 × 16–19 μ (37·5 × 17·5 μ).

Hab. in foliis *Eugeniae* spec., South Kanara, Bombay, India, 27. iii. 1913, leg. *Ranganath* (typus in Herb. Mycol., Imperial Agric. Research Institute, New Delhi, India).

20. **Meliola Scolopiae** Doidge, var. **zeylanica** Hansf., var. n.

Plagulae amphigenae, atrae, densae, velutinae, orbiculares, usque ad 3 mm. diam. *Mycelium* ex hyphis atrobrunneis, subrectis vel irregulariter sinuoso-flexuosis, 7–9 μ crassis (cellulis plerumque 15–20 μ longis), alternatim vel irregulariter (raro opposite) ramosis, densissime reticulatis compositum. *Hyphopodia capitata* alternata, recta vel curvata, 20–35 μ longa, cellula basali cylindracea, 6–12 μ longa, cellula apicali fortiter stellatim 3–6-lobata, saepe curvata, 15–25 × 15–25 μ. *Hyphopodia mucronata* pauca, dispersa, alternata vel unilateralia, conoidea vel ampullacea, 20–26 × 7–9 μ. *Setae myceliales* numerosae, dispersae, erectae, atrae, rectae vel leniter flexuosae, 400–1100 × 9–11 μ, simplices, obtusae vel subacutae. *Perithecia* dispersa, atra, globosa, verrucosa, 180–240 μ diam. *Sporae* atrobrunneae, ellipsoideae, utrinque rotundatae, 3-septatae, constrictae, 53–59 × 18–22 μ.

Hab. in foliis *Scolopiae crassipedis*, Hakgala, Ceylon, *Herb. Peradeniya 5208.*

21. **Meliola simillima** Ell. & Ev., var. **zeylanica** Hansf., var. n.

Plagulae epiphyllae, atrae, subvelutinae, orbiculares, 0·5–1 mm. diam., numerosae, confluentes. *Mycelium* ex hyphis atrobrunneis, sinuoso-flexuosis, 5–6 μ crassis (cellulis plerumque 15–20 μ longis), opposite ramosis (45–90°), laxe reticulatis compositum. *Hyphopodia capitata* alternata, 10–14 μ longa, cellula basali cylindracea, 2–5 μ longa, cellula apicali globosa, integra, 7–9 μ diam. *Hyphopodia mucronata* dispersa, alternata vel opposita, ampullacea, plus minusve curvata, 12–17 × 5–7 μ, collo 2–3 μ crasso. *Setae myceliales* dispersae, erectae, atrae, rectae, simplices, acutae, 240–400 × 7–8 μ. *Perithecia* dispersa, atra, globosa, verrucosa, usque ad 150 μ diam. *Sporae* atrobrunneae, cylindraceae, utrinque rotundatae, 4-septatae, constrictae, 26–32 × 11–13 μ (28·5 × 11·5 μ).

Hab. in foliis *Hemidesmi indici*, Waga, Ceylon, *Herb. Peradeniya 5116.*

22. **Meliola tenella** Pat., var. **atalantiae** (Pat.) Hansf., comb. n.

Syn. *Meliola bambusae* Pat. var. *atalantiae* Pat. in Journ. de Bot. 1897, p. 348 ; Saccardo, Syll. Fungorum, XIV, p. 471.

On *Atalantia monophylla*, Anuradhapura, Ceylon, *Herb. Peradeniya 4767.*

Colonies epiphyllous, dense, black, velvety, up to 2 mm. diam. Mycelium of dark brown sub-straight hyphae 8–10 μ thick, the cells mostly 15–20 μ long, branching opposite and close at about 60° densely reticulate. Capitate hyphopodia alternate, straight and parallel to the mycelial branches, 17–22 μ long, stalk cell cylindric 5–8 μ long, head cell cylindric with rounded apex to somewhat clavate, entire, usually straight 11–19 × 9–11 μ. Mucronate hyphopodia very few, scattered alternate ampulliform. Mycelial setae numerous erect black straight 160–200 μ high, 2–3 times dichotomous above with the branches reflexed-spreading, primary branches –90 μ, 2-ry to 50 μ, 3-ry to 20 μ long, acute. Perithecia scattered black globose verrucose up to 200 μ diam. Spores dark brown, cylindric to somewhat ellipsoid with rounded ends, 4-septate, constricted, 42–50×18–21 μ (45·5×19·5 μ).

23. **Meliola toddaliicola** Hansf., sp. n.

Plagulae epiphyllae, raro etiam hypophyllae, atrae, orbiculares, usque ad 1 mm. diam., tenuissimae, aegre perspicues. *Mycelium* ex hyphis atrobrunneis, subrectis vel leniter flexuosis, 6–7 μ crassis (cellulis plerumque 20–25 μ longis), opposite ramosis (60–90°), laxe reticulatis compositum. *Hyphopodia capitata* alternata vel usque ad 40 per cent opposita, leniter antrorsa, plerumque recta, 12–15 μ longa ; cellula basali cylindracea, 2–6 μ longa, cellula apicali globosa vel ovata, raro cylindracea, integra, 9–2 μ×7–9 μ. *Hyphopodia mucronata*, dispersa, opposita vel alternata, ampullacea, recta vel curvata, 12–17×6–8 μ, collo 2 μ crasso. *Setae myceliales* praecipue juxta perithecia evolutae, erectae, atrae, simplices, rectae, subacutae, usque ad 200×7–8 μ. *Perithecia* dispersa, atra, globosa, leniter verrucosa, usque ad 140 μ diam., hyphis radiantibus hyphopodiatis, usque ad 80 μ longis circumdata. *Sporae* atrobrunneae, cylindraceae, utrinque rotundatae, 4-septatae, leniter constrictae 37–41×15–17 μ.

Hab. in foliis *Toddaliae asiaticae*, Kisubi, Entebbe, Uganda, *Hansford 3645 p.p.*

24. **Meliola transvaalensis** Doidge, var. **Afrardisiae** Hansf., var. n.

Plagulae amphigenae, atrae, velutinae, densae, orbiculares, usque ad 5 mm. diam. *Mycelium* ex hyphis atrobrunneis, subrectis vel flexuosis, 8–10 μ crassis (cellulis plerumque 15–20 μ longis), opposite ramosis (45–90°), dense reticulatis compositum, in centro plagularum saepe subsolidum. *Hyphopodia capitata* alternata vel opposita, suberecta vel antrorsa, recta vel varie curvata, 19–26 μ longa ; cellula basali cylindracea, 5–10 μ longa, cellula apicali ovata, integra vel angulosa, raro sublobata, apice rotundata vel truncata, 12–18×10–15 μ. *Hyphopodia mucronata* dispersa, alternata vel opposita, ampullacea, plus minusve curvata, 22–28×8–10 μ, collo elongato curvato 3·5–5 μ crasso. *Setae myceliales* paucae vel numerosae, dispersae et juxta perithecia aggregatae, erectae, atrae, opacae, rectae, simplices, subacutae, 300–800×10–13 μ, sursum gradatim attenuatae. *Perithecia* dispersa vel in centro plagularum subaggregata atra, globosa, verrucosa, usque ad 270 μ diam. *Sporae* atrobrunneae, cylindraceae vel subellipsoideae, utrinque rotundatae, 4-septatae, constrictae, 53–60×18–23×15–18 μ (av. 56·5×21·0 μ).

Hab. in foliis *Afrardisiae dentatae*, Mt. Biega, Kivu, Congo Belge, *F. L. Hendrickx 2532.*

25. **Meliola Vitis** Hansf., sp. n.

Plagulae epiphyllae, atrae, densae, velutinae, orbiculares, usque ad 3 mm. diam., vel confluentes. *Mycelium* ex hyphis atrobrunneis, flexuosis, intertextis, 6–8 μ crassis (cellulis plerumque 20–30 μ longis), irregulariter ramosis, dense reticulatis compositum, in centro plagularum subsolidum. *Hyphopodia capitata* alternata vel dispersa, recta vel curvata, 20–30 μ longa, cellula basali cylindracea, 4–8 μ longa, cellula apicali versiformi, cylindracea, clavata vel subtriangulata, recta vel curvata, apice rotundata vel truncata, 15–24×9–16 μ. *Hyphopodia mucronata* dispersa, opposita vel alternata, conoidea vel ampullacea, recta vel curvata, 22–26×7–9 μ. *Setae myceliales* numerosae, dispersae, erectae, rectae, atrae, circa 200 μ alt. et 8–11 μ cr., sursum 2-3–dichotomae, ramis late reflexo-patentibus, primariis –50 μ, secondariis –30 μ, tertiariis

–20 μ longis, acutis. *Perithecia* dispersa, atra, globosa, verrucosa, 130–160 μ diam. *Sporae* atrobrunneae, cylindraceae, utrinque rotundatae, 4-septatae, constrictae, 35–42 × 12–15 μ (38·5 × 13·5 μ).

Hab. in foliis *Vitis Rheedii*, Kalutara, Ceylon, *Herb. Peradeniya 5014.*

26. **Meliola Zanthoxyli** Hansf., sp. n.

Plagulae epiphyllae, atrae, densae, velutinae, orbiculares, usque ad 3 mm. diam. *Mycelium* ex hyphis atrobrunneis, subrectis vel leniter flexuosis, 9–11 μ crassis (cellulis plerumque 15–20 μ longis), opposite ramosis (60–90°), dense reticulatis compositum, in centro plagularum subsolidum. *Hyphopodia capitata* alternata, antrorsa, plerumque recta, 25–32 μ longa, cellula basali cylindracea, 8–13 μ longa, 7–12 μ cr., cellula apicali subglobosa, irregulariter fortiter 3–6-lobata, 12–24 × 15–22 μ. *Hyphopodia mucronata* dispersa, plerumque alternata, ampullacea, plus minusve curvata, 15–20 × 6–10 μ. *Setae myceliales* numerosae, erectae, atrae, simplices, obtusae, 300–400 × 10–12 μ, sursum late hamatae vel uncinatae. *Perithecia* dispersa, atra, globosa, verrucosa, 180–250 μ diam. *Sporae* atrobrunneae, oblongo-ellipsoideae, utrinque rotundatae, 4-septatae, constrictae, 50–58 × 21–24 μ.

Hab. in foliis *Zanthoxyli tetraspermi*, Hakgala, Ceylon, *Herb. Peradeniya 5597.*

SPHAERIACEAE.

27. **Apiosporina Harunganae** Hansf., sp. n.

Mycelium hypophyllum, verisimiliter omnino superficiale, inter hyphas *Brachysporii harunganae* interspersum, ex hyphis dilute brunneis, 2–3·5 μ crassis, septatis, irregulariter ramosis, laxe reticulatis, exhyphopodiatis, minute denseque spiculiferis compositum. *Perithecia* laxe irregulariterque dispersa, omnino superficialia, atra, globosa vel sursum lenissime papillata, 70–120 μ diam. et alt. ; paries exterior unistratosus, parenchymaticus, cellulis angulosis, 5–10 μ diam. et circa 7 μ crassis ; paries interior indistinctus, ex strato uno cellulis hyalinis compressis compositus. *Setae peritheciales* circa 15, in parte superiore irregulariter dispersae, erectae vel reflexae, deorsum leves, sursum spiculiferae, 4–5 μ crassae, septatae, saepe in hyphas mycelii vergentes. *Asci* basales, aparaphysati, erecti, ellipsoidei, breviter nodoso stipitati, sursum late rotundati incrassati (–5 μ), 8-spori, 50–65 × 20–24 μ. *Sporae* 2–3-seriatae, clavulatae, utrinque rotundatae, medio 1-septatae, lenissime constrictae, 18–23 × 7–8 μ, cellula superiore crassiore, leves, primo hyalinae demum dilute olivaceae.

Hab. in foliis *Harunganae madagascariensis*, Kisubi, Entebbe, Uganda, *Hansford 3541.*

28. **Balladynella Vernoniae** Hansf., sp. n.

Plagulae epiphyllae, atrae, usque ad 8 mm. diam. vel confluentes. *Mycelium superficiale* ex hyphis brunneis, septatis, subrectis vel flexuosis, 3–5 μ crassis, irregulariter ramosis, subdense reticulatis, exhyphopodiatis compositum. *Mycelium intramatricale* sub cuticulam folii evolutum, ex membranis orbiculatis, usque ad 60 μ diam., irregulariter dispersis plerumque juxta pilos folii compositum, in centro membranae cellulis atrobrunneis, prosenchymaticis, marginem versus cellulis radiantibus, hyalinis, aegre perspicuis. *Haustoria* nulla. *Perithecia* dispersa, superficialia, globosa vel breviter conoidea ; atra, 100–120 μ diam., glabra vel cellulis parietis singulis in hyphas mycelii productis ; paries parenchymaticus unistratosus, cellulis angulosis 7–9 μ diam., extus atrogranulosus, apice poro irregulari pertusus. *Asci* basales, usque ad 20, in successione maturescentes, erecti, ellipsoidei, subsessiles, sursum rotundati, leniter incrassati, 8-spori, aparaphysati, usque ad 65×20 μ. *Sporae* 2–3-seriatae, oblongo-clavulatae, utrinque rotundatae, brunneae, leves, 1-septatae, leniter constrictae, 18–23×9–10 μ, cellula superiore crassiore breviore.

Conidia myceliala laxe irregulariterque dispersa, sessilia, in hyphis mycelii lateralia, in juventute hyphopodia globosa simulantia, in maturitate typica V-formia vel obclavata, subopace atrobrunnea, transverse 3–4-septata et interdum leniter constricta, sursum attenuata, apice rotundata, usque ad 70×15 μ, extus atro-granulosa, interdum elongata et setas myceliales simulantia.

Hab. in foliis *Vernoniae wightianae*, Hakgala, Ceylon, ***Herb. Peradeniya* 5289** (typus), *5281*.

The creeping brown external mycelium penetrates the host cuticle at scattered points, usually near a leaf hair, and forms a small group of dark thick-walled cells at the point of penetration ; from these hyaline hyphae radiate outwards to form a thin plate up to 60 μ diam. beneath the cuticle, very difficult to observe. There is no other penetration of the host, and no haustoria are formed in the underlying epidermal cells. The mycelial conidia are typically V-shaped, though sometimes one arm does not develop, and some are much elongated and then resemble mycelial setae.

29. **Dimerium ugandense** Hansf., sp. n.

Mycelium tenue, ex hyphis flexuosis, hyalinis vel subhyalinis, exhyphopodiatis, 3–4 μ crassis compositum, hyphis hospitis adnatum. *Perithecia* dispersa, brunnea, globosa vel leniter papillata, 60–80 μ diam., glabra, subtranslucentia ; paries extus ex cellulis angulosis, 5–8 μ diam., brunneis, levibus, unistratosis, et intus ex cellulis hyalinis, fortiter compressis, unistratosis compositus. *Asci* basales, aparaphysati, sessiles, ellipsoidei, sursum rotundati, haud incrassati, in ordine maturescentes, 8-spori, usque ad 40×15 μ. *Sporae* 2–3-seriatae, atrobrunneae, ellipsoideae, utrinque rotundatae, 1-septatae, leniter constrictae, 14–17×5–7 μ, cellulis subaequalibus vel superiore leniter crassiore, leves.

Pycnidia peritheciis consimilia ; conidia oblonga, utrinque rotundata vel subtruncata, brunnea, levia, continua, 8–10×4·5–5·5 μ.

Hab. in plagulis *Cheiropodii flagellati* Syd. in foliis *Scleriae* spec. indet., Kisubi, Entebbe, Uganda, *Hansford 3590*.

30. **Licopolia keniensis** Hansf., sp. n.

Perithecia hypophylla, densissime usque ad 50 in greges irregulariter dispersos aggregata, usque ad 1 mm. diam. *Stroma* exterius prosenchymaticum, usque ad 40 μ alt., margine in hyphis atrobrunneis, exhyphopodiatis, septatis, flexuosis, laxe reticulatis, omnino superficialibus dissolvens ; stroma inferne ad hypostroma et recte per cuticulam et per stomata folii plurie affixum. *Hypostroma* cellulas epidermales plures implens, et sub epidermide in hyphas hyalinas dissolvens, interdum inter cellulas subepidermidis penetrans ; haustoria nulla. *Perithecia* dense aggregata et saepe subconnata, atra, nitentia, ovata vel globosa, glabra, subdura, 100–140 μ diam. et alt. ; paries exterior ex cellulis atris, 8–15×3–8 μ, compositus, 2–4-stratosus ; paries interior hyalinus, parenchymaticus, 2–3-stratosus, ex cellulis fortiter compressis compositus. *Asci* basales, fasciculati, aparaphysati, erecti, ellipsoidei, sursum late rotundati et leniter incrassati, subsessiles, 8-spori, 50–75×18–27 μ. *Sporae* 2–3-seriatae, oblongae. utrinque rotundatae, 1-septatae, leniter constrictae, leves, rectae, 21–26×7–9 μ, cellula superiore leniter breviore et crassiore.

Hab. in foliis *Oleae chrysophyllae*, Londiani, Kenya, *F. L. Hendrickx 2576*.

The external stromata are scattered irregularly over the lower surface of the leaf and are irregularly pulvinate up to 1 mm. diam. The upper surface

is completely covered with the very densely aggregated perithecia, which are black and shining, rather hard and with an irregular apical pore. Around the edge of the stroma the cells are produced into dark brown, loose exhyphopodiate septate hyphae, creeping over the leaf and often enclosing single leaf scales, but not penetrating the cuticle or stomata. The stroma tissue is hard, black, and consists of dark, rounded to angular prosenchyma, up to 40 μ thick above the leaf, and continuous above with the hard outer walls of the perithecia, which are often more or less connate. On the lower surface the external stroma is connected both directly through the cuticle and also through the stomata with groups of dark cells filling many epidermal cells of the leaf; thence passing through the lower walls of the epidermis and forming a loose thin layer of hyaline hyphae above the subepidermis, sometimes penetrating between the cells of this layer, but not reaching further into the mesophyll; no haustoria are formed in the leaf. The cell walls of many cells of the subepidermal layer show some proliferation, and their walls stain a faint pink with Sudan III, showing a chemical alteration from the normal condition.

The present fungus differs from the South African *Balladyna confusa* on *Olea* spp. in the more closely aggregate and harder perithecia and in the presence of an external stroma; also it forms a dark hypostroma in the epidermis. In structure *Licopolia keniensis* is intermediate between Dothideaceae and Sphaeriaceae, and could be placed in either family according to whether the external perithecial wall is considered as belonging to the stroma or not.

31. **Nematothecium ugandense** Hansf., sp. n.

Mycelium in plagulis *Ireninae entebbeensis* parasiticum, ex hyphis hyalinis vel dilute olivaceis, flexuosis, septatis, exhyphopodiatis, 2–3 μ crassis compositum, tenue, aegre perspicuum. *Perithecia* dense irregulariterque dispersa, globosa vel ovata, interdum leniter papillata, 70–110 μ diam., et alt., sessilia, atro- vel rufo-brunnea, glabra; paries unistratosus, parenchymaticus, ex cellulis angulosis, 7–10 μ diam. compositus. *Asci* basales, numerosi, fasciculati, clavato-cylindracei, 30–35 × 8–10 μ, 8-spori; paraphyses numerosae, filiformes, hyalinae, simplices, 1 μ cr. *Sporae* parallele positae, anguste clavulato-cylindraceae, rectae, dilute brunneae, leves, 5-septatae, haud constrictae, 20–26 × 3 μ, apice obtusae, deorsum attenuatae et basi subacutae.

Hab. in plagulis *Ireninae entebbeensis* in foliis *Alchorneae cordifoliae*, Entebbe Road, Uganda, *Hansford 3620*.

In general appearance the perithecia much resembles those of *Dimerium* (*Bolosphaera*) *subferrugineum*.

HYPOCREACEAE.

32. **Ophionectria Vernoniae** Hansf., sp. n.

Perithecia hypophyla, superficialia, inter pilos folii laxe irregulariterque dispersa, dilute lutea, globosa vel ovoidea, 100–140 μ diam., 160–220 μ alt., haud setosa; paries circa 15 μ cr., extus ex hyphis dilute luteis, densissime intertextis, intus ex stratis 3–5 cellularum hyalinarum fortiter compressarum compositus. *Asci* basales, numerosi, cylindracei, sessiles, subrecti, apice rotundati, haud incrassati, 8-spori, usque ad 110 × 10–12 μ. *Sporae* parallele positae, filiformes, hyalinae, transverse 4–7-septatae, haud constrictae, leves, 80–100 × 2 μ.

Hab. in foliis *Vernoniae campaneae*, Entebbe Road, Uganda, *Hansford 3502*.

The fungus appears to be completely saprophytic, developing its loosely scattered perithecia on a very thin and loosely reticulate superficial mycelium of narrow flexuous hyaline hyphae, not forming a visible colony.

CHAETOTHYRIACEAE.

33. **Microcallis Rutideae** Hansf., sp. n.

Mycelium superficiale, ex hyphis hyalinis vel dilute luteis, 1·5–3 μ cr., indistincte septatis, exhyphopodiatis, irregulariter ramosis compositum, tenuissimum, aegre perspicuum, late effusum, juxta perithecia tenuiter pelliculosum et pariete perithecii confluens. *Perithecia* irregulariter laxeque dispersa, superficialia, sessilia, depresso-globosa vel subovata, atrobrunnea, 50–80 μ diam., 50–110 μ alt. ; paries exterior parenchymaticus, ex cellulis atrobrunneis, angulosis, 6–10×4–8 μ compositus, basim versus in hyphis mycelii vergens, sursum cellulis numerosis in processibus clavatis, brunneis, 1–2-septatis, 10–25×7–10 μ productis, apice pallidiore poro indistincto pertusus ; paries interior indistinctus, hyalinus. *Asci* basales, erecti, ellipsoidei vel saccati, sessiles, apice obtuse rotundati incrassatique (–10 μ), 8-spori, usque ad 43×15 μ. *Sporae* parallele positae, hyalinae, clavulato-cylindraceae, utrinque rotundatae, leves, medio 1-septatae, haud constrictae, 19–23×3·5–5 μ, saepe sursum leniter crassiores. *Paraphyses* paucae, filiformes, hyalinae, continuae, simplices, 1 μ cr., indistinctae.

Hab. in foliis *Rutideae Smithii*, Entebbe Road, Uganda, *Hansford 3558*.

34. **Chaetothyrium Petchii** Hansf., sp. n.

Plagulae amphigenae, plerumque epiphyllae, atrae, leves, effusae, tenues, pelliculosae. *Mycelium* ex hyphis rectis vel leniter flexuosis, dilute brunneis, 5–10 cr., (cellulis 20–30 μ longis), opposite saepe cruciatim ramosis, ad septa haud vel leniter constrictis, dense reticulatis, exhyphopodiatis compositum, omnino superficiale. *Perithecia* dispersa, atra, depresso-globosa, in sicco cupulato-collabescentia, sessilia, 180–250 μ diam., 100–150 μ alt. ; paries exterior atrobrunneus, ex strato uno cellularum angulosarum, 9–12 μ diam. compositus, sursum setis radiantibus, rectis, atris, simplicibus, subacutis, septatis, usque ad 100×6–10 μ subdense ornatus, apice poro anguloso pertusus, deorsum in hyphis mycelii vergens ; paries interior hyalinus, parenchymaticus, indistinctus. *Asci* basales, aparaphysati, ellipsoidei, sessiles, apice rotundati, leniter incrassati (–4 μ), 8-spori, usque ad 100×25 μ. *Sporae* 2–3-seriatae, fusoideae, utrinque rotundatae, rectae vel curvulae, 3-septatae, haud vel lenissime constrictae, hyalinae vel chlorino-hyalinae, leves, 27–35×6–9 μ.

Hab. socio insectorum in folii *Citri aurantii*, Hatton, Ceylon, *Herb. Paradeniya 6576.*

CAPNODIACEAE.

35. **Limacinia ericophila** (Link) Hansf., comb. n.

Syn. *Antennaria ericophila* Link in Species Plant. v, p. 118.

Forms a thick black, rather soft coating over the twigs up to 2 mm. thick, consisting of loosely interwoven short branches of mycelium in which the perithecia are more or less buried. Mycelium entirely superficial, of dark brown hyphae 10–20 μ wide, the cells more or less globose and strongly constricted at the septa ; outer wall smooth or indistinctly granular ; branching close and irregular.

Perithecia scattered, globose, black, up to 180 μ diam. and high, superficial or buried in the mycelial mat, at the apex with indistinct irregular pore ; wall of an outer layer of dark brown parenchyma 7–10 μ diam., lined with an inner indistinct layer of hyaline cells 3–6 μ diam., or possibly this inner layer is composed of interwoven hyaline hyphae ; the whole wall 6–10 μ thick, membranous, smooth on outer surface ; the upper part of the perithecium bears few to many erect setiform chains of cells similar to the mycelium, but smaller, the chains straight, unbranched, obtuse, up to 80 μ long by 7–10 μ thick ; the lower part of the perithecium with similar descending-radiating hyphal struts.

Asci basal fasciculate from an indistinct hyaline basal plectenchyma, erect, straight or bent, ellipsoid to clavulate, narrowed below into a short wide stripe, attenuate-rounded and thickened up to 8 μ at the apex, 8-spored, aparaphysate, up to 100 × 30 μ. Spores obliquely 2–3-seriate ellipsoid to clavate, dark brown with pale tips, rounded at the ends, when mature 5-septate, not or very slightly constricted at one or more septa, 32–40 × 11–15 μ.

Hab. on twigs of *Erica arborea*, Mt. Biega, Kivu, Congo Belge, *F. L. Hendrickx 2537*.

Link originally described *Antennaria ericophila* as occurring on the trunk of *Erica arborea* in Portugal, and from the rather vague description given in Saccardo, Syll. Fung. I, p. 82, it seems probable that it is identical with Hendrickx's specimen above.

STIGMATEACEAE.

36. **Entopeltis Hendrickxii** Hansf., sp. n.

Plagulae epiphyllae, leves, laxe dispersae, orbiculares, 3–4 mm. diam., griseae, leniter elevatae. *Mycelium* omnino subcuticulare, ex hyphis laxe radiantibus, irregulariter ramosis, dilute olivaceis, 8–11 μ cr. compositum; cellulis hypharum saepe longioribus et brevioribus alternantibus, illis usque ad 20 μ, his 5–8 μ longis, septis transversis, crassis, atrobrunneis. *Thyriothecia* subcuticularia, depresso-conica, margine haud fimbriata, atra, 100–130 μ diam., in centro circa 40 μ alt.; paries superior ex hyphis opace atrobrunneis radiantibus compositus, apice poro pertusus; paries inferior hyalinus, tenuis, ex hyphis intertextis compositus, sursum in hypothecium et paraphyses vergens. *Asci* pauci, apicem versus thyriothecii directi, ellipsoidei vel saccati, deorsum in stipitem nodosum brevem contracti, apice rotundati, incrassati (–10 μ), 8-spori, usque ad 60 × 25 μ. *Paraphyses* hyalinae, filiformes, simplices, dubie septatae, 1 μ cr. *Sporae* pluriseriatae vel conglobatae, ovatae, apice rotundatae, deorsum leniter attenuatae, basi subtruncatae, continuae, leves, atrobrunneae, 14–16 × 8–10 μ, in medio zona subhyalina circa 2 μ cr. praeditae.

Hab. in foliis *Rauwolfiae* spec. indet., Mt. Kahuzi, Kivu, Congo Belge, *F. L. Hendrickx 2472*.

MICROTHYRIACEAE.

37. **Cocconia Halleriae** Hansf., sp. n.

Stromata epiphylla, laxe vel subdense dispersa, orbicularia, atra, concentrice rugosa, usque ad 8 mm. diam., rarius etiam hypophylla minora. *Mycelium* superficiale nullum, intramatricale in epidermide aggregatum, ex cellulis dilute brunneis, circa 6 × 4 μ compositum, subparenchymaticum, inferne in hyphis hyalinis intercellularibus dissolvens; haustoria nulla. *Ascostroma* ex loculis annulatis 2–4 plus minusve continuis compositum, centro sterili; loculi longitudinaliter dehiscentes; stratum tegens ex hyphis opace atrobrunneis compositum, circa 10 μ cr.; hyphis 4–6 μ cr., parallelo-radiantibus, septatis, 2–3-stratosis; paries inferior dilute brunneus vel subhyalinus, circa 5 μ cr., ex hyphis dense intertextis compositus, sursum in hypothecium vergens. *Asci* numerosi, erecti, ellipsoidei, apice late rotundati, incrassati (–10 μ), basi subsessiles, 8-spori, circa 80 × 30–35 μ. *Sporae* 2–3-seriatae, atrobrunneae, oblongae utrinque rotundatae, 1-septatae, constrictae, leves 26–32 × 12–14 μ, cellula superiore leniter crassiore. *Paraphyses* erectae, simplices, septatae, filiformes, 2 μ cr., sursum leniter crassiores, obtusae.

Hab. in foliis *Halleriae lucidae*, Aberdare Mts., Kenya, *Hansford 3523* (ex *P. Chandler 2356* in Herb. Botanist, Uganda).

The interior of the mature loculus becomes filled with mucus, which is stained brown when exposed by the disintegration of the upper wall after dehiscence. The lower wall of the ascoma is connected to the pale brown hypostroma in

the epidermal cells by numerous scattered single hyphae direct through the cuticle. In many respects this fungus corresponds to the description of *Pleiostomella halleriae* Doidge in Bothalia, I, p. 17, 1921, but the spores are quite different, though it is possible that the South African species was described from immature specimens.

38. **Echidnodes Canthii** Hansf., sp. n.

Plagulae epiphyllae, atrae, densae, usque ad 3 mm. diam., leves. *Mycelium* ex hyphis brunneis, flexuosis vel sinuosis, 3·5–5 μ crassis (cellulis plerumque, 15–20 μ longis), irregulariter ramosis, dense reticulato-radiantibus, exhyphopodiatis compositum, omnino superficiale; mycelium intramatricale sub centro plagularum evolutum, subcuticulare, atrobrunneum, 1–2-stratosum, ex cellulis prismaticis, circa 10×4–6 μ compositum, membranam rotundatam vel leniter lobatam usque ad 500 μ diam. et 15 μ alt. efformans, haustoriis nullis. *Thyriothecia* dense aggregata et subconfluentia, radiantia, elongato-ellipsoidea vel linearia, plerumque singula, atra, convexa, 200–400×90–120 μ, levia, longitudinaliter dehiscentia; paries superior unistratosus, atrobrunneus, opacus, ex hyphis radiantibus 4–5 μ crassis compositus, margine in hyphis mycelii dissolvens; paries inferior plectenchymaticus, ex hyphis tortuoso-radiantibus compositus, in centro dilute brunneus, marginem versus subhyalinus, sursum in paraphyses numerosas, erectas, hyalinas, 1·5–3 μ crassas dissolvens. *Asci* numerosi, erecti, late clavati vel ovati, subsessiles vel breviter nodoso-stipitati, apice late rotundati, incrassati (–3 μ), 8-spori, usque ad 60×28 μ. *Sporae* 2–3-seriatae vel conglobatae, atrobrunneae, oblongae, utrinque rotundatae, leves, 1-septatae, constrictae, 18–23×9–11 μ, cellulis subaequalibus vel superiore lenissime crassiore.

Hab. in foliis *Canthii montani*, Hakgala, Ceylon, *Herb. Peradeniya 5282.*

The internal mycelium is limited to the centre of the colony beneath the dense mass of mycelial hyphae and thyriothecia, to which it is connected at frequent intervals by simple hyphae direct through the cuticle. There is no further penetration of the host, and no haustoria are formed in the epidermal cells.

39. **Echidnodes Embeliae** Hansf., sp. n.

Plagulae epiphyllae, atrae, orbiculares, densae, leves, usque ad 3 mm. diam., in maculas minutas, dilute brunneas vel flavo-chlorinas dispositae. *Mycelium* superficiale, ex hyphis atrobrunneis, 3–5 μ crassis, undulato-tortuosis, irregulariter ramosis, exhyphopodiatis, dense reticulatis et subsolidis compositum, cellulis plerumque 10–20 μ longis. *Hypostroma* sub epidermide et inter cellulas strati paliformis evolutum, atrum, laxe parenchymaticum, in mesophyllo in hyphas dilute olivaceas vel subhyalinas, septatas, intercellulares dissolvens, haustoriis nullis. *Thyriothecia* dense stipata, ellipsoidea, linearia vel X- Y-formia, atra, longitudinaliter dehiscentia, opaca, usque ad 800×240 μ; paries superior radiatus, ex hyphis septatis, opace atrobrunneis compositus, in centro usque ad 60 μ alt., margine in hyphis mycelii vergens; paries inferior dilute brunneus, ex hyphis reticulatis compositus. *Paraphyses* numerosae, hyalinae vel sursum dilute olivaceae, tortuoso-erectae, septatae, 2–3 μ crassae, ascos leniter superantes. *Asci* numerosi, erecti, cylindracei vel saccati, subsessiles, sursum rotundati et incrassati (–4 μ), 35–45×17–22 μ, 8-spori. *Sporae* multiseriatae vel conglobatae, oblongae, utrinque rotundatae, brunneae, 1-septatae, leniter constrictae, 15–18×7–8 μ, cellulis subaequalibus vel superiore lenissime crassiore, extus leves.

Conidia in mycelio laxe dispersa, cylindracea vel leniter obclavata, erecta, opace atro-brunnea, transverse 2–5-septata, recta vel curvula, levia, apice rotundata, basi truncata, sessilia, 35–50×6–8 μ.

Hab. in foliis *Embeliae Schimperi*, Kalengu, Kivu, Congo Belge, *F. L. Hendrickx 2490.*

40. **Echidnodes Pittospori** Hansf., sp. n.

Plagulae epiphyllae, atrae, 1–2 mm. diam., leniter elevatae, in maculas rufo-brunneas, margine flavas dispositae. *Mycelium* superficiale ex hyphis brunneis, exhyphopodiatis, reticulatis, indistincte septatis, rectis vel leniter sinuosis, 3 μ crassis, irregulariter laxeque ramosis, radiantibus compositum ; mycelium intramatricale subcuticulare, ex massis atrobrunneis, parenchymaticis, usque ad 100 μ diam. et ad 30 μ alt. compositum ; haustoria nulla. *Thyriothecia* dense disposita et subconfluentia, elliptica, linearia vel irregulariter elongata, usque ad 500 × 130 μ, atra, convexa, omnino superficialia ; paries inferior dilute olivaceus, ex hyphis meandericis vel irregulariter radiantibus compositus, inferne cum mycelio subcuticulari plurie connexus, sursum in hypothecium laxum vergens ; paries superior opace atrobrunneus, unistratosus, ex hyphis radiantibus, 4–5 μ crassis compositus, margine laxe fimbriatus, hyphis fimbriarum tortuoso-radiantibus, brunneis, exhyphopodiatis, usque ad 40 μ longis. In maturitate thyriothecium longitudinaliter rimosum, parte centrali secedenti ascos detegenti. *Asci* numerosi, erecti, in juventute ovati, apice late rotundati, incrassati (–5 μ), deorsum in stipitem brevem nodosum contracti, in maturitate elongati vel subcylindracei, usque ad 60 × 18 μ, 8-spori. *Paraphyses* numerosae, hyalinae, filiformes, septatae, 2 μ crassae. *Sporae* pluriseriatae, brunneae, leves, oblongae, utrinque rotundatae, 1-septatae, leniter constrictae, 15–18 × 7–8 μ, cellula superiore leniter crassiore.

Hab. in foliis *Pittospori abyssinici*, Kalengu, Kivu, Congo Belge, *F. L. Hendrickx 2547*.

In immature condition this fungus has been collected repeatedly on the type host in Uganda. The colonies are very small and inconspicuous, each on a slightly elevated rusty-brown leafspot surrounded by a narrow yellow margin. Beneath the whole central part of each colony there are numerous subcuticular masses of dark parenchymatous mycelium, which does not penetrate further into the leaf and does not form haustoria in the underlying epidermal cells. The latter turn brown and are filled with dark brown granular matter, deeper in the leaf the brown staining pales to yellow. The internal mycelium is connected at frequent intervals by single hyphae direct through the cuticle to the lower surface of the external ascomata, which are thus loosely connected to the host. At maturity the asci are embedded in a thin brown layer of mucus.

41. **Eupelte Rapaneae** Hansf., sp. n.

Plagulae epiphyllae, atrae, dense dispersae, usque ad 1 mm. diam., leves, orbiculares, in centro densae. *Mycelium* ex hyphis brunneis, sinuosis, 5 μ crassis (cellulis 10–20 μ longis), irregulariter ramosis, ex centro denso radiantibus, exhyphopodiatis compositum. *Conidia* in hyphis mycelii singulariter dispersa, erecta, cylindracea, apice rotundata, deorsum subattenuata, basi truncata, atrobrunnea, levia, 2–4-septata, 35–65 × 9–11 μ. *Mycelium intramatricale* sub centro plagulae evolutum, cum hyphis superficialibus plurie connexum, ex hyphis hyalinis, septatis, subcuticularibus compositum, inter cellulas epidermidis penetrans et sub epidermide laminam tenuem, unistratosam efformans, hyphis singulis inter cellulas strati paliformi in mesophyllo penetrantibus, haustoriis nullis. *Thyriothecia* circum centrum sterile plagulae dense disposita, atra, leniter convexa, orbicularia vel ellipsoidea, saepe connata, circa 150 μ diam., in composito usque ad 400 × 200 μ ; paries superior opace atrobrunneus, radiatus, margine in hyphis mycelii dissolutus ; paries inferior subhyalinus, ex hyphis tortuosis, septatis compositus. *Asci* numerosi, erecti, cylindracei vel clavati, apice late rotundati, incrassati (–10 μ), subsessiles, 8-spori, circa 50 × 20 μ. *Paraphyses* paucae, ascos superantes, sursum irregulariter ramosae et epithecium laxum, dilute brunneum efformantes, septatae, circa 3 μ crassae. *Sporae* 2–3-seriatae, brunneae, oblongae utrinque rotundatae, leves, 1-septatae, constrictae, 17–20 × 9–10 μ, cellulis subaequalibus vel superiore leniter crassiore.

Hab. in foliis *Rapaneae pulchrae*, Mt. Biega, Kivu, Congo, Belge, *F. L. Hendrickx 2516.*

ASTERINACEAE.

42. **Asterolibertia Flabellariae** (Syd.) Hansf., comb. n.

Syn. *Lembosia flabellariae* Syd. in Ann. Myc. XXXVI, p. 189, 1938.

As exemplified by *Deighton 2275* on *Flabellaria paniculata*, Sembehun, Horahun, Sierra Leone, the mycelium of this species produces intercalary hyphopodia typical of the genus *Asterolibertia* ; these were originally described by Sydow as swollen cells of the mycelium, but each has a conspicuous pore on its lower surface, marking the attachment of the epidermal haustorium.

43. **Clypeolella Hendrickxii** Hansf., sp. n.

Plagulae epiphyllae, atrae, leves, orbiculares, usque ad 6 mm. diam., tenues vel densae, interdum subcrustosae et in maturitate facile secedentes. *Mycelium* ex hyphis atrobrunneis, subrectis, 7–9 μ crassis (cellulis plerumque 10–20 μ longis), dense irregulariterque ramosis compositum, in centro plagularum subsolidum. *Hyphopodia* alternata vel unilateralia, rarissime opposita, continua, hemisphaerica, integra, 8–12 × 12–18 μ. *Conidia* helminthosporioidea, subdense dispersa, clavata, curvata, 3-septata, leniter constricta, levia, apice obtuse rotundata, basi attenuato-pedicellata, cellulis mediis atro-brunneis, cellulis terminalibus pallidioribus 50–65 × 16–19 μ ; conidia singula, terminalia, in sterigmatibus elongatis, curvatis, erectis, dilute olivaceis vel subhyalinis, usque ad 70 × 4–5 μ efformata ; sterigmata singula ex cellulis ramorum breviorum mycelii oriunda. *Thyriothecia* plerumque in centro plagularum dense aggregata, saepe connata, sub hyphis mycelii crescentia, orbicularia, leniter convexa, atra, levia, usque ad 500 μ diam., in maturitate in centro irregulariter rimosa, et cellulis parietis superioris secedentibus ; paries superior unistratosus, radiatus, atrobrunneus, ex hyphis 8–9 μ crassis (cellulis 10–15 μ longis), compositus, margine haud fimbriatus ; paries inferior dilute olivaceus vel subhyalinus, ex hyphis tortuoso-radiantibus, septatis compositus. *Asci* numerosi, in successione maturescentes, aparaphysati, globosi, sessiles, 8-spori, usque ad 50 μ diam. *Sporae* conglobatae, atrobrunneae, oblongae, utrinque rotundatae, 1-septatae, leniter constrictae, leves, 30–36 × 15–18 μ, cellulis subaequalibus vel superiore leniter crassiore.

Hab. in foliis *Grumileae* spec. indet., Mt. Biega, Kivu, Congo Belge, *F. L. Hendrickx 2517.*

44. **Asterina Garciniae** Hansf., sp. n.

Plagulae epiphyllae, orbiculares, atrae, leves, tenues, dispersae, usque ad 5 mm. diam. *Mycelium* ex hyphis brunneis, 3·5–5 μ crassis (cellulis plerumque 10–20 μ longis), flexuosis vel sinuosis, irregulariter ramosis, laxe reticulatis compositum. *Hyphopodia* dispersa, alternata vel unilateralia, continua, hemisphaerica, integra, 7–10 × 5–7 μ, saepe leniter hyphis obscuriora. *Thyriothecia* dense stipata, raro singula, orbicularia, 80–160 μ diam., atra, convexa, plerumque irregulariter 2–3-connata ; paries inferior hyalinus, indistinctus ; paries superior subopace atrobrunneus, ex hyphis radiantibus, 4–5 μ crassis compositus, margine plus minusve fimbriatus, hyphis fimbriarum exhyphopodiatis, tortuoso-radiantibus, usque ad 60 μ longis, saepe laxe connatis, in maturitate stellatim dehiscens et late apertus. *Asci* numerosi, aparaphysati, ellipsoidei, clavati vel ovati, sessiles, apice late rotundati, haud incrassati, 45–50 × 23–28 μ, 8-spori. *Sporae* brunneae, oblongae, utrinque rotundatae, 1-septatae leniter constrictae, 18–23 × 10–12 μ, cellulis subaequalibus vel superiore leniter crassiore, episporio levi, maturae cellula utraque zono medio pallidiore praedita.

Hab. in foliis *Garciniae mangostanae*, Ooty, South India, 6. iii. 1944, leg. *Ramakrishna* (typus in Herb. Coimbatore, South India).

45. ASTERINA GREWIAE Cooke in Grevillea, x, p. 130, 1882.
On *Trimeria bakeri*, Londiani, Kenya, *F. L. Hendrichx 2579*.

46. **Asterina hakgalensis** Hansf., sp. n.

Plagulae epiphyllae, tenues, atrae, leves, orbiculares, usque ad 4 mm. diam. *Mycelium* ex hyphis atrobrunneis, flexuosis vel sinuosis, 3–4 μ crassis (cellulis plerumque 20–25 μ longis), irregulariter ramosis, laxe reticulatis compositum. *Hyphopodia* in hyphis primariis evoluta, distantia, alternata vel unilateralia, hemisphaerica, integra, continua, 6–8 μ diam., saepe hyphis brevibus, tortuosis circumdata. *Haustoria* in cellulis subepidermidis singulariter disposita, inter cellulas epidermidis penetrantia, granulosa, reniformia, cellulis hospitis fere implentia. *Thyriothecia* dispersa, orbiculata, 100–150 μ diam., atra, convexa, levia ; paries inferior indistinctus ; paries superior convexus, opace atrobrunneus, unistratosus, ex hyphis radiantibus, 4 μ crassis compositus, margine fimbriatus, hyphis fimbriarum exhyphopodiatis, tortuoso-radiantibus, usque ad 80 μ longis, in maturitate stellatim dehiscens et late apertus. *Asci* usque ad 25, in successione maturescentes, aparaphysati, late ovati vel subglobosi, 8-spori, sessiles, 30–35 × 30 μ. *Sporae* conglobatae, oblongo-clavulatae, utrinque rotundatae, 1-septatae, constrictae, leves, 20–24 × 9–11 μ, atrobrunneae, cellulis subaequalibus vel superiore leniter crassiore, in germinatione hyphopodium prope septum efformantes.

Hab. in foliis *Rhododendri arborei*, Hakgala, Ceylon, *Herb. Peradeniya 3476*.

The presence of rather dense groups of short tortuous hyphae around the hyphopodia is reminiscent of many species of Microthyriaceae having internal mycelium, but such is absent in the present fungus, which is therefore a true *Asterina*.

46 *bis*. ASTERINA LORANTHICOLA Syd. in Ann. Myc. XII, p. 266, 1914.
On *Losanthus usuiensis*, Entebbe Road, Uganda, *Hansford 3498*.

This specimen corresponds very closely with the description given by Doidge in Bothalia, IV, p. 302, 1942.

47. **Asterina Lobeliae** Hansf., sp. n.

Plagulae amphigenae, plerumque epiphyllae, minutae, tenues, orbiculares, atrae, leves, usque ad 0·5 mm. diam., numerosae, dense dispersae. *Mycelium* ex hyphis brunneis, 3–4 μ crassis (cellulis plerumque 12–25 μ longis), sinuosis vel tortuosis, irregulariter ramosis, laxe radiantibus compositum. *Hyphopodia* alternata vel unilateralia, continua, versiformia, cylindracea vel lobata, 7–12 × 5–10 μ. *Thyriothecia* in centro plagularum dense disposita, orbiculata, atra, leniter convexa, 60–80 μ diam., saepe 2–3-connata et usque ad 180 × 100 μ ; paries superior atrobrunneus, ex hyphis radiantibus, 5 μ crassis compositus, margine haud vel leniter fimbriatus, hyphis fimbriarum tortuosis, radiantibus, usque ad 40 μ longis, in maturitate stellatim dehiscens, et late apertus, ascos detegens. *Asci* usque ad 20, aparaphysati, globosi, sessiles, 8-spori, circa 25 μ diam. *Sporae* conglobatae, brunneae, oblongae, utrinque rotundatae, 1-septatae, leniter constrictae, leves, 16–18 × 6·5–7·5 μ, cellulis subaequalibus. *Pycnidia* thyriotheciis consimilia ; conidia oblonga vel piriformia, brunnea, zono medio subhyalino praedita, levia, 13–17 × 5–8 μ.

Hab. in foliis *Lobeliae* spec. (? *L. gibberoa*), Mt. Biega, Kivu, Congo Belge, *F. L. Hendrickx 2520*.

48. **Asterina Murrayae** Hansf., sp. n.

Plagulae hypophyllae, tenues, atrae, leves, usque ad 5 mm. diam., vel confluentes. *Mycelium* ex hyphis atrobrunneis, subrectis vel flexuosis, 4–5 μ crassis (cellulis plerumque 20–25 μ longis), opposite vel irregulariter ramosis, laxe reticulatis compositum. *Hyphopodia* alternata vel dispersa, continua, pulvinata vel clavata, interdum 2–3-sublobata, 8–10 × 5–10 μ. *Thyriothecia* dispersa, orbiculata, atrobrunnea, convexa, 130–170 μ diam. ; paries inferior indistinctus, ex hyphis subhyalinis radiantibus compositus ; paries superior subopace atrobrunneus, ex hyphis radiantibus, 3·5–4·5 μ crassis, cellulis 5–12 μ longis compositus, margine crenatus vel leniter fimbriatus, hyphis fimbriarum paucis, tortuoso-radiantibus, in maturitate stellatim dehiscens. *Asci* 4–10, aparaphysati, ovati vel globosi, sessiles, 8-spori, 40–50 × 30–40 μ. *Sporae* conglobatae, atrobrunneae, oblongae, utrinque rotundatae, 1-septatae, constrictae, 22–26 × 11–13 μ, cellulis subaequalibus vel superiore crassiore, episporio sublevi vel subtiliter echinulato.

Hab. in foliis *Murrayae exoticae*, Hakgala, Ceylon, *Herb. Peradeniya 5115.*

Many hyphae are almost devoid of hyphopodia, and the thyriothecia are rarely connate or compound.

49. **Asterina Micheliae** Hansf., sp. n.

Plagulae hypophyllae, atrae, tenues, leves, orbiculares, usque ad 2 mm. diam. vel confluentes. *Mycelium* ex hyphis dilute brunneis, flexuosis, 3·5–5·5 μ crassis (cellulis plerumque 15–20 μ longis), irregulariter ramosis, laxe reticulatis compositum. *Hyphopodia* continua, alternata vel unilateralia, raro opposita, hemisphaerica vel breviter cylindracea, dilute brunnea, integra, 4–8 × 4–7 μ. *Thyriothecia* dense stipata, atra, orbiculata, 120–150 μ diam., plerumque simplicia ; paries inferior indistincte radiatus, subhyalinus ; paries superior primo ex hyphis atrobrunneis, radiantibus, 5–6 crassis, cellulis usque ad 10 μ longis compositus, demum cellulis secedentibus et in muco natentibus, sed marginem versus dispositionem radiatam tenens. *Asci* aparaphysati, 5–8, in ordine maturescentes, ovati vel subglobosi, sessiles, 8-spori, 40–50 × 40–45 μ. *Sporae* conglobatae, atrobrunneae, leves, oblongae, utrinque rotundatae, 1-septatae, constrictae, 27–30 × 14–15 μ, cellula superiore crassiore, ambabus subglobosis.

Pycnidia thyriotheciis consimilia, 80–120 μ diam. ; conidia atrobrunnea, piriformia vel ellipsoidea, levia, continua, 20–29 × 11–14 μ.

Hab. in foliis *Micheliae nilgiricae*, Hakgala, Ceylon, *Herb. Peradeniya 5189.*

In mature condition the thyriothecia very closely resemble the perithecia of *Englerulella*, but their primary structure and development are typical of *Asterina*, though the dehiscence is rather by mucose degeneration of the upper wall than by stellate fracture ; the pycnidia are somewhat less mucose than the thyriothecia.

50. **Asterina olacicola** Hansf., sp. n.

Plagulae amphigenae, plerumque epiphyllae, atrae, densae, leves. *Mycelium* ex hyphis atrobrunneis, sinuosis, subopacis, 5–7 μ crassis (cellulis plerumque 25–30 μ longis), opposite vel irregulariter ramosis, dense reticulatis compositum. *Hyphopodia* alternata vel opposita, rarius ternata, dispersa vel congregata, conoidea vel cylindracea, recta vel curvula, atrobrunnea, integra, 7–14 × 5–9 μ. *Thyriothecia* et pycnidia intermixta, numerosa, opaca, atra, saepe plagulam totam implentia. *Pycnidia* 50–110 μ diam., orbiculata ; paries superior radiatus, inferior radiatus, pallidior ; conidia atrobrunnea, subopaca, piriformia, continua, levia, 18–23 × 13–16 μ. *Thyriothecia* orbiculata, 80–120 μ diam., opace atrobrunnea, convexa ; paries superior ex hyphis radiantibus, 4–6 μ crassis, cellulis 4–8 μ longis compositus margine haud fimbriatus ; paries inferior indistinctus ; in maturitate stellatim dehiscentia. *Asci* 4–8, aparaphysati, globosi vel ovati, sessiles, 8-spori 50–60 × 40–45 μ, membrana 1·5 μ crassa. *Sporae* conglobatae, atrobrunneae, oblongae, utrinque rotundatae, 1-septatae, constrictae, 27–32 × 13–15 μ, episporio levi, cellula superiore leniter majore, in maturitate subopacae.

Hab. in foliis *Olacis wightianae*, Nandi Hills, Mysore, India, 19. ii. 1944 (Herb. Thirumalachar, Bangalore, India).

51. **Asterina Spathodeae** Hansf., sp. n.

Plagulae epiphyllae, dispersae, orbiculares, 1–3 mm. diam., tenues, atrae, leves. *Mycelium* ex hyphis brunneis, subrectis vel flexuosis, irregulariter ramosis, 3·5–4·5 μ crassis (cellulis 20–50 μ longis), laxe reticulatis compositum. *Hyphopodia* alternata vel dispersa (hyphis multis exhyphopodiatis), 1-septata, 8–16 μ longa, cellula basali cylindracea, recta vel curvata, 2–8 μ longa, cellula apicali clavata vel subglobosa, integra, rarius leniter sinuoso-irregulari, interdum uncinata vel pediformi, 7–10 × 5–7 μ. *Thyriothecia* dense stipata, saepe orbiculata, discreta et usque ad 130 μ diam., vel 2–3-confluentia, atra, convexa, levia ; paries superior unistratosus, radiatus, ex hyphis radiantibus 3–5 μ crassis, cellulis 5–10 μ longis compositus, margine plus minusve laxe fimbriatus, hyphis fimbriarum exhyphopodiatis, tortuoso-radiantibus, usque ad 100 μ longis, in maturitate stellatim dehiscens et late apertus, parte centrali secedenti ; paries inferior ex hyphis dilute chlorino-griseis radiantibus compositus. *Asci* usque ad 20, in ordine maturescentes, indistincte paraphysati, globosi vel ovati, 8-spori, sessiles, 30–35 × 28–33 μ. *Sporae* conglobatae, atrobrunneae, oblongae, utrinque rotundatae, 1-septatae, constrictae, 15–18 × 8–9 μ, cellulis subaequalibus vel superiore leniter crassiore, episporio minute atrogranuloso.

Hab. in foliis *Spathodeae niloticae*, Entebbe Road, Uganda, *Hansford 3566*.

AGYRIACEAE.

52. **Lecideopsella Brideliae** Hansf., sp. n.

Ascomata hypophylla, laxe irregulariter dispersa, discoidea, rubiginosa, usque ad 200 μ diam. et 40 μ alt., margine leniter irregularia. *Mycelium* aegre perspicuum, ex hyphis hyalinis vel dilute flavis, septatis, irregulariter ramosis, exhyphopodiatis, 2–4 μ crassis, laxe reticulatis compositum, late effusum, omnino superficiale. *Asci* dense dispersi, in contextu laxe fibroso, ex paraphysibus hyalinis, ramosissimis, septatis, flexuosis, 1–2 μ crassis composito, sursum epithecio fulvo ex hyphis 2–4 μ crassis unistratosis composito velati ; asci unistratosi, singulariter dispersi, ellipsoidei vel clavati, apice late rotundati, incrassati (–10 μ), deorsum in stipitem brevem crassam contracti, recti vel curvati, usque ad 40 × 20 μ, 8-spori. *Sporae* multi-seriatae vel conglobatae, clavulatae, utrinque rotundatae, hyalinae, leves, 1-septatae, leniter constrictae, 12–15 × 5–6 μ.

Hab. in foliis *Brideliae micranthae*, Entebbe Road, Uganda, *Hansford 3602*.

LEPTOSTROMACEAE.

53. **Leptostroma Scutiae** Hansf., sp. n.

Maculae epiphyllae, atrae, orbiculares, usque ad 3 mm. subtiliter concentrice rugosae ; epidermis folii cellulis prismaticis atris impleta, et clypeo simulans ; cellulis 2–4-stratosis, 6–15 × 3–5 μ ; in mesophyllo hyphae numerosae penetrantes, intercellulares septatae, haustoriis nullis. *Loculi* plurie irregulariter concentrice dispositi, elongati, primo epidermide velati, demum longitudinaliter aperti, usque ad 40 μ alt. *Conidiophora* erecta, simplicia, hyalina, continua, densissime stipata, usque ad 25 × 2–2·5 μ. *Conidia* singula, terminalia, oblonga, utrinque rotundata, hyalina, continua, levia, recta, 7–10 × 3–4·5 μ.

Hab. in foliis *Scutiae myrtinae*, Ngong Hills, near Nairobi, Kenya, *F. L. Hendrickx 2566*.

There is no external mycelium in this species, and the visible part of the fungus consists of the circular areas of the leaf epidermis filled with black pseudoparenchyma. Below this ' clypeus ' hyaline hyphae penetrate between the cells of the subepidermis and palisade layers, and many of these host cells are filled with a dark brown amorphous substance, especially in the subepidermis, where almost a continuous layer is thus formed. The hyphae in the mesophyll are both intra- and intercellular, but no haustoria are formed. The conidial loculi are formed below the darkened epidermis, and have no other upper wall ; at maturity the epidermis splits along the centre of the concentric loculi and finally becomes widely open to expose the very dense palisade of conidiophores. The latter arise from a thin hyaline pseudoparenchyma above the upper wall of the subepidermis.

MONILIACEAE.

54. **Hyalodendron Clematidis** Hansf., sp. n.

Maculae in epiphyllo brunneae, siccae, 1–3 mm. diam., margine angusta atrobrunnea circumdatae, raro confluentes, indistincte zonatae, rotundatae vel leniter angulosae, in hypophyllo pallidiores, et saepe conidiophoris velatae. *Conidiophora* dense fasciculata (–100), hyalina, erecta, sursum irregulariter ramosa, septata, usque ad 150 μ alt., 3·5–5 μ cr., ramulis in conidiis catenulatis secedentibus. *Conidia* ovata vel cylindracea, 0–1–2-septata, hyalina, levia, utrinque subtruncata, 6–30 × 3·5–5 μ.

Hab. in foliis *Clematidis simensis*, Kalengu, Kivu, Congo Belge, *F. L. Hendrickx 2491.*

The fungus has exactly the structure of a *Cladosporium* with the branches of the conidiophore breaking up into segments which form the conidia ; the ultimate branchlets consist of short chains of continuous ovate conidia, while the lower branches form the larger 1–2-septate conidia. All parts of the fungus are completely hyaline and smooth.

55. **Didymaria Skierkae** Hansf., sp. n.

Mycelium in soris *Skierkae* parasiticum, ex hyphis hyalinis, 2–3 μ crassis, irregulariter ramosis, septatis compositum, hyphis in uredosporis hospitis penetrantibus. *Conidiophora* suberecta, usque ad 80 μ longa, simplicia vel 1-furcata, subrecta vel sursum geniculata, hyalina, 3–3·5 μ crassa, ad septas superiore sterigma unum circa 2 μ longum efformantia. *Conidia* in sterigmatibus singula, terminalia, clavata, hyalina, levia, sub medio 1-septata et leniter constricta, apice late rotundata, deorsum attenuata et basi leniter apiculata, 14–16 × 5–6 μ.

Hab. in uredosoris *Skierkae congensis* in foliis *Alchorneae cordifoliae,* Kivu, Congo Belge, *F. L. Hendrickx 2560.*

The conidia are obclavate, hyaline, 1-septate below the middle, the upper cell considerably larger than the lower, and broadly rounded at the apex ; the lower cell attenuate to the base which bears part of the sterigma as a small apiculus. The conidia are single on each sterigma, and originally terminal on the conidiophore, which becomes septate just above the sterigma, and grows on to form other sterigmata and conidia in succession, one at each node.

56. **Eriomycopsis Meliolinae** Hansf., sp. n.

Mycelium in plagulis *Meliolinae* parasiticum, tenue, album, ex hyphis hyalinis, 2–3 μ crassis, exhyphopodiatis, flexuosis vel tortuosis, irregulariter ramosis, indistincte septatis, laxe reticulatis compositum. *Conidiophora* lateralia, erecta, irregulariter vel dense stipata, simplicia, recta vel flexuosa, usque ad 50 μ longa, 1–3-septata, apicem versus sterigmatibus minutis praedita. *Conidia* in sterigmatibus singulariter evoluta, plus minusve cylindracea vel

lenissime obclavata, plerumque recta, hyalina, 1–3-septata, haud constricta, levia, apice obtuse vel subacute rotundata, basi in hilo plano attenuata, usque ad 40×3·5–4·5 μ.

Hab. in plagulis *Meliolinae octosporae* in foliis *Syzygii cordati*, Entebbe Road, Uganda, *Hansford 3598.*

Often all parts of the fungus are stained yellow-brown to violet with a soluble dye derived from the parasitized host fungus. The same species occurs on *Meliolina* sp. on *Eugenia gerrardii*, Northern Transvaal, South Africa, *Herb. Pretoria 33297 a.*

57. **Cercosporella Albizziae** Hansf., sp. n.

Maculae nullae. *Conidiophora* hypophylla, dense fasciculata, hyalina, demum dilutissime fulva, continua, usque ad 20×5 μ, simplicia. *Conidia* filiformia, recta vel curvata, apice rotundata, basi truncata, 5-septata, haud constricta, hyalina, levia, usque ad 60×2 μ.

Hab. in foliis *Albizziae grandibracteatae*, socio *Microstroma Albizziae* Syd., Kalengu, Kivu, Congo Belge, *F. L. Hendrickx 2487.*

58. **Cercosporella Hypoestis** Hansf., sp. n.

Maculae nullae. *Conidiophora* hypophylla, in areas indistinctas albas vel dilute flavidas evoluta, parce-fasciculata, per stomata folii erumpentia, hyalina, erecta vel patentia, recta vel irregulariter curvata, simplicia, usque ad 70 μ longa, basi 6–8 μ crassa, sursum nodulosa. *Conidia* singula, terminalia, cylindracea, recta vel curvula, hyalina, 3–6-septata, apice rotundata, basi subtruncata, 30–70×3–4·5 μ.

Hab. in foliis *Hypoestis verticillaris*, Mt. Kahuzi, Kivu, Congo Belge, *Hansford 3573 p.p.*

The conidiophores are produced through the stomata on the lower side of the leaf in small divergent fascicles without a definite stroma in the leaf, on indefinite white to pale yellow areas of the host leaf.

59. **Titaea verrucosa** Hansf., sp. n.

Mycelium tenuissime pelliculosum, ex hyphis hyalinis 2–4 μ crassis, septatis, irregulariter ramosis compositum. *Conidia* laxe singulariter dispersa, hyalina, muriformia, subglobosa, usque ad 35 μ diam., extus verrucosa vel subechinulata, ex cellulis subglobosis 10–12 et aliis 4, subcylindraceis, obtusis, rectis, radiantibus, levibus, usque ad 40×5 μ composita.

Hab. in foliis *Motandrae altissimae*, Entebbe Road, Uganda, *Hansford 3562.*

In this collection the fungus occurs amongst colonies of *Meliola* and *Asterina*, but is very doubtfully parasitic on either of these. The conidia are produced each by the transformation of a short erect lateral branch of the creeping mycelial hyphae, and each consists of a main axis of two small, smooth cells surrounded by a single layer of 12–16 cells to form a globose mass up to 35 μ diam., verrucose on the whole external surface except for four cells which grow out into radiating straight cylindric obtuse ‘ spines ’ up to 40 μ long.

DEMATIACEAE.

60. **Atractina Jasmini** Hansf., sp. n.

Plagulae hypophyllae, tenues, effusae, oculo nudo haud perspicuae. *Mycelium* ex hyphis dilute olivaceis, flexuosis, 2–3 μ crassis, septatis, irregulariter ramosis, laxe vel subdense reticulatis, exhyphopodiatis, superficialibus compositum. *Conidiophora* laxe irregulariter dispersa, interdum laxe fasciculata, erecta, atrobrunnea, plus minusve recta, simplicia, levia, septata, usque ad 600×10–12 μ, sursum leniter gradatim attenuata et pallidiora, ad septa 2–3 superiora verticillatim ramosa itaque capitem gerentia ; ramis erecto-adnatis, dilute olivaceis, rectis vel flexuosis, septatis, simplicibus, usque ad 50 μ longis, apice conidium singulum gerentibus. *Conidia* terminalia, singula, obclavata, dilute olivacea, basi rotundata demum invaginata, apice attenuato-rotundata, levia, 3–5-septata, leniter constricta, plus minusve curvata, 30–45 × 8–10 μ.

Hab. in foliis *Jasmini dichotomi*, Entebbe Road, Uganda, *Hansford 3467*.

The conidiophores are very characteristic, consisting of a dark simple main axis bearing a rather dense head of verticillate short branches arising from the topmost two or three septa of the axis ; each branch bears a single terminal conidium on a dark, slightly raised scar, and by continued growth produces others in rapid succession, while the scars of the original conidia become lateral. The conidia are obclavate and at first rounded at the base, later the basal hilum becomes irregularly invaginated.

61. **Cercospora Marsdeniae** Hansf., sp. n.

Maculae atro-purpureae, dispersae, angulosae, 1–3 mm. diam., purpureo-cinctae, in hypophyllo atrobrunneae. *Conidiophora* ex stromate substomatali atro-olivaceo, usque ad 50 μ diam., et 40 μ alt., dense parenchymatico oriunda, fasciculata, sursum leniter divergentia, recta vel curvula, dilute olivacea, 0–2-septata, simplicia vel raro irregulariter furcata, cylindracea, circa 60 μ longa et 4 μ crassa. *Conidia* dilutissime olivacea, cylindracea, levia, recta vel curvata, 2–7-septata, non vel leniter constricta, singula, terminalia, 30–90 × 3·5–5 μ, basi subtruncata, haud incrassata, apice obtuse rotundata.

Hab. in foliis *Marsdeniae angolensis*, Entebbe Road, Uganda, *Hansford 3543*.

Apparently each conidiophore forms only a single terminal conidium and does not grow further ; the terminal scar is not prominent.

62. **Cercospora Fagarae** Hansf., sp. n.

Maculae nullae. *Conidiophora* hypophylla ex stomatibus folii parce fasciculatim oriunda (stromate intramatricali indistincto), erecta, sursum divergentia, 100–250 × 5 μ, simplicia vel irregulariter furcata, olivacea, sursum irregulariter geniculata. *Conidia* olivacea, leniter obclavata, plerumque curvata, singula, terminalia, 40–100 × 6–8 μ, sursum leniter attenuata, apice obtuse rotundata, basi subtruncata haud incrassata, 3–9-septata, lenissime constricta, levia, rarius furcata.

Hab. in foliis *Fagarae* spec. indet., Entebbe Road, Uganda, *Hansford 3569*.

The fungus forms a thin olivaceous mould over the greater part of the infected leaflets, consisting of loosely fasciculate erect or somewhat divergent olivaceous conidiophores, irregularly furcate and geniculate in the upper part, bearing terminal conidia which later become lateral by continued growth of the axis. There is no definite stroma in the stomatal cavities of the leaf.

63. **Cercospora Balladynae** Hansf., sp. n.

Mycelium in plagulis *Balladynae* parasiticum, ex hyphis dilute olivaceis 2 μ crassis, septatis, irregulariter ramosis, flexuosis, exhyphopodiatis compositum. *Conidiophora* dispersa, erecta, olivacea, cylindriacea, 3–5-septata, usque ad 100 × 5–7 μ, simplicia. *Conidia* singula, terminalia, elongato-obclavata, dilute olivacea, basi truncata haud incrassata, sursum attenuata, apice rotundata, 3–7-septata, haud constricta, levia 50–80 × 5–7 μ.

Hab. in plagulis *Balladynae* spec., in foliis *Pavettae* spec., Entebbe Road, Uganda, *Hansford 2609* (typus), *3452*.

64. GRALLOMYCES PORTORICENSIS Stevens in Bot. Gaz. LXV, p. 245, 1918.

On *Scutia myrtina*, Entebbe Road, Uganda, *Hansford 3637 p.p.*

So far this is the only record of this fungus in Uganda, but we have seen many specimens of it from Sierra Leone, where it appears to be common on a wide range of host plants. The description given by Stevens is accurate. No evidence of parasitism was found in any of the specimens examined.

PROCEEDINGS OF THE GENERAL MEETING ON 7 March 1946

Colonel F. C. Stern, O.B.E., M.C., Vice-President,
in the Chair.

The Proceedings of the General Meeting held on Thursday, 21 February 1946, having been circulated, were taken as read and confirmed.

The following were thanked for gifts made to the Library since the last meeting :—Prof. F. E. Weiss, the Scottish Marine Biological Station, Millport, and the South Australian Museum, Adelaide.

Certificates recommending the election of the following candidates for Associateship were read for the first time,—in favour of Miss Erica Millicent Moore, B.Sc., and Gordon Edgar Barnes, M.A.

The following was elected an Associate,—Anthony Johnston, B.Sc.

The Vice-President in the Chair reported the death of Professor John Stanley Gardiner, F.R.S.

The following communications were read and discussed :—

Mr. John Chear. Beneath the Trees. (Colour Film.) (Discussed by Dr. R. Melville, Miss R. F. Shove, Dr. Malcolm Smith ; Mr. Chear replied.)

Dr. D. L. Gunn. Experiments in attacking locust swarms from aircraft. (Colour Film.) (Discussed by Dr. B. P. Uvarov, Mr. W. F. Higgins, who showed a slide recording the stridulation of locusts. Dr. Malcolm Smith, Dr. R. Melville ; Dr. Gunn replied.)

THE LIFE-HISTORY OF CORIXA PANZERI FIEB.

By Muriel Sutton, B.A.,
from the Department of Biology, Chelsea Polytechnic.

(Communicated by Mr. C. C. Hentschel, M.Sc., F.L.S.)

(Plates 2 & 3, and 4 text-figures)

[Read 10 May 1945]

Introduction.

Corixa (*Corixa*) *panzeri* Fieb.* is one of the four species of large British Corixidae ; it is comparatively uncommon and its life-history has not previously been described. It is found, in nature, in alkaline or brackish water ; Walton (1933) has recorded it in very small numbers in a few ponds in Somerset, where it favours ‘ clear, slightly alkaline water ’ ; and Brown (1943) has found it, again in very small numbers, in North Wales,—for example in pools behind sand dunes, on Malldraeth Sands on the south side of Malldraeth Bay, where the water is clear and ‘ probably slightly brackish ’. It has also been found by Mr. W. E. China in brackish water marshes near the Thames to the east of Gravesend (oral communication).

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* Nomenclature according to China (1938).

The sources of supply for the purposes of this work were four Emergency Water Supply tanks, belonging to the National Fire Service on Chelsea Embankment, one on each side of the Albert and Battersea Bridges. The species was first noted in September 1943, in the tank to the east of Battersea Bridge and, by 1945, the three remaining tanks had become colonized. The water in these tanks came from the Thames, which at this point is slightly brackish. The actual salinity of the tanks, owing to dilution with rain water and to evaporation, varied between 41·8 and 203 parts of sodium chloride per 100,000. However, the species is able to live and breed in water less alkaline, and of considerably lower salinity than it favours in nature. Specimens were kept in glass aquaria filled with water from the original tanks, diluted at least fifty per cent. with tap water. On several occasions eggs hatched and nymphs developed to the second, and once to the third, instar in tap water alone. Thus there appears to be a tolerance of quite a wide range of salinities and *p*H. The dominant flora of the E.W.S. tanks was *Cladophora* sp. and *Rhizoclonium* sp., and there was a big population of Chironomid larvae upon which the adult *C. panzeri* fed readily. There was little bottom soil in the tanks, merely a covering of mud, about 4 inches deep.

Adults were taken from the tanks on 23 March, 1945, and 6 April, 1945, and at intervals thereafter, until the tanks were emptied by the National Fire Service. The first eggs appeared on 16 April, and those which were fertile were transferred to two large tongue jars. At intervals during the summer, fresh pairs of adults were placed in tongue jars, in which they laid eggs, and these eggs in turn hatched. The temperature of the water in the tongue jars varied between 14°–18° C. Notes were kept of the lengths of time elapsing between successive ecdyses. The number of individual nymphs observed during the season was not large, and a very heavy mortality at the end of the second stadium reduced the already small population. Only one of the eight second instar nymphs hatched from eggs laid in the tongue jars, completed the ecdysis to the third instar and this nymph died soon afterwards. A few third instar nymphs taken from the E.W.S. tanks during this period and in September, October and November 1943, reached the fifth stadium, but of these only three achieved the ecdysis leading to the imago. One third instar nymph lived for sixteen days without ecdysis, and then died, in November 1943. The results of these observations are given in Table I.

TABLE I.

	Egg to 1st instar.	1st to 2nd instar.	2nd to 3rd instar.	3rd to 4th instar.	4th to 5th instar.	5th instar to imago.
Time in days......	10–15	7–10	8	7–11	8–11	7–10

Nymphs were collected from the E.W.S. tanks until January 1944, when the temperature was 4° C., but the numbers collected then were very small, and the specimens were found in the covering of mud at the bottom of the tanks.

The heavy mortality at the end of the second stadium makes it difficult to breed this species in aquaria, and, should it be a general phenomenon in the life-history of most species of Corixidae, it may account for the small number of records of Corixids completing their life-cycle in captivity.

Description of the Egg and Five Nymphs.

The Egg (fig. 1).—The eggs are usually laid singly upon the stems and leaves of water plants ; in the aquaria and tongue jars they were found on *Fontinalis* sp., but one group of about eight eggs was laid upon the shell of *Limnea* sp. To the naked eye they appear a deep cream colour, but by transmitted light they are a delicate greenish white, with, after the second day, the embryo as a pale brown arc, visible in the centre. At a later stage the embryonic eyes can clearly be seen.

The egg is 1 mm. long and 0·75 mm. wide at the widest point. The egg is attached to the object upon which it is laid by a basal disc, and at the distal end there is an operculum which is an aid to the emerging first instar nymph. The form of the egg can be seen in fig. 1, and it will be noted that the chorion is sculptured in a regular pattern.

The First Instar Nymph . (Plates 2 & 3).—These nymphs average 1·9–2 mm. long and 1·2 mm. wide at the widest point, which in all instars is in the region of the third abdominal segment. The shape is a very rounded oval, and the combined length of the head and thorax (0·9 mm.) is practically the same as that of the abdomen (1·0 mm.). The abdomen shows a very marked, central, dorsal ' visceral hump ', with extremely thin lateral ' flanges ', where the sternum and tergum of each segment are apposed. There is a corresponding but smaller ventral ' hump '.

Fig. I.

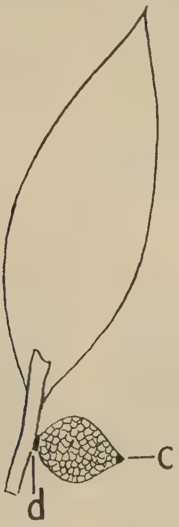


Fig. 1.—Egg of *C. panzeri* on *Fontinalis* sp.
***d*=basal disc. *c*=distal cap. ×20.**

The colour is a very pale greenish cream, with a dark brown edging to all the abdominal segments except the last ; there are also narrow bands of the same colour on the ' visceral hump ' region of segments 3–7 of the abdomen, and on the thorax as shown in fig. 2. The eyes are red. It would seem that this shape and coloration are not unique to the first instar nymph of *C. panzeri*, since Griffiths (1945) has recorded a similar description of the first instar of *Rhamphocorixa acuminata*. The first instar of *C. punctata*, however, is quite differently coloured. At this stage in *C. panzeri* the pigmentation is poorly developed, as is evidenced by the facts that specimens preserved in methylated spirits rapidly lose their colour, while third, fourth, and fifth instar nymphs retain their colours for a longer time.

Chitinization is also not so well developed as in the third, fourth, and fifth instar, and several of the internal organs, notably the heart, Malpighian tubules, and the alimentary canal can easily be seen in living specimens. The thinness of the chitin may be concomitant with the respiratory mechanism of early Corixid nymphs.

The most marked feature of the head is the small size of the eyes in comparison with the total area of the head. As an indication of this certain measurements can be given ; each eye, viewed dorsally, measures 0·1 mm. in width, giving a total width of 0·2 mm., the width of the whole head is 1 mm., thus the ratio of eye width to head width is 1 : 5. It is interesting to note the alterations in this ratio in later instars. The ventral view shows a short rostrum as compared with later instars ; evidence of this is the presence of only three transverse lines on this structure, a number which increases in later nymphs. The total length of the dorsal surface of the head from the vertex to the tip of the labrum is 0·9 mm. The tips of the mandibular and maxillary stylets can be seen as four small points unusually widely separated for a member of the Hemiptera. There is a very slight oval depression in the frons. From the posterior edge of the head capsule to the vertex measures 0·5 mm.

Fig. 2.

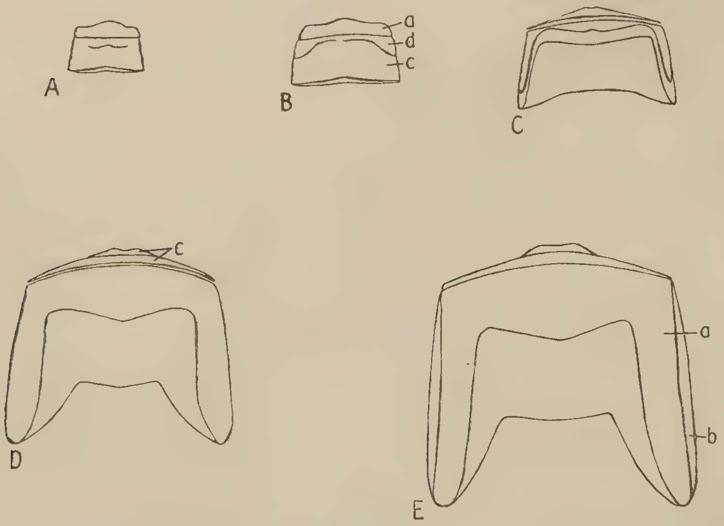
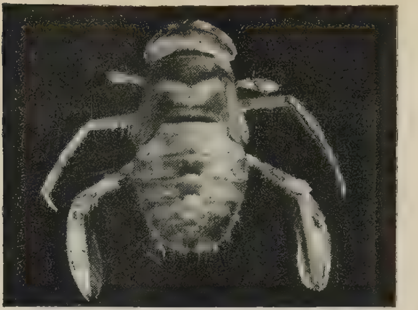


Fig. 2.—Thoracic segments of the five nymphs of *Corixa panzeri*. Dorsal view. A=1st nymph ; B=2nd nymph ; C=3rd nymph ; D=4th nymph ; E=5th nymph. *a*=anterior wing pad; *b*=posterior wing pad ; *c*=pronotum ; *d*=mesonotum ; *e*=metanotum.

The thorax (fig. 2) is divided completely into two parts, one of which is the prothorax. The meso- and metathorax are completely fused laterally, but in the central dorsal region they are clearly separated. A narrow, white mid-dorsal line running longitudinally through the thorax marks a line of weakness along which the cuticle splits at ecdysis.

The abdomen shows nine segments clearly marked, which is interesting in view of the description by Caroli (1924) of the first nymph of *Corixa monticelli*



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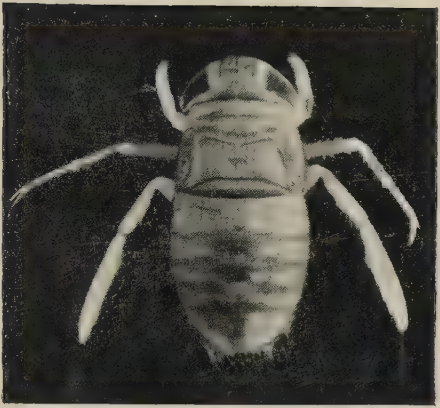

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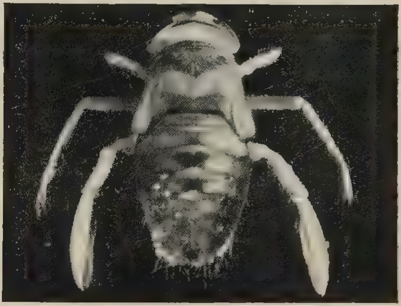

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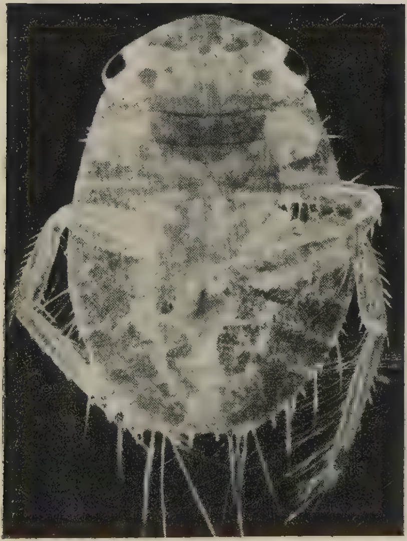

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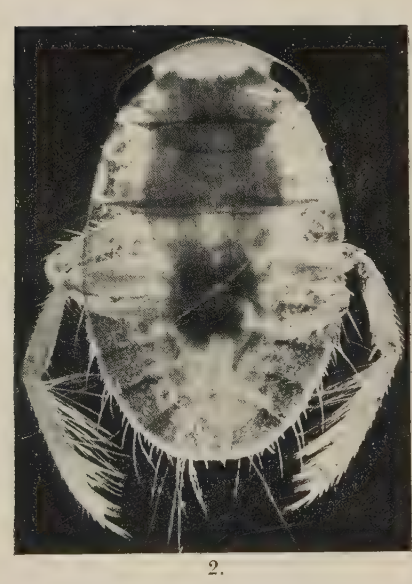
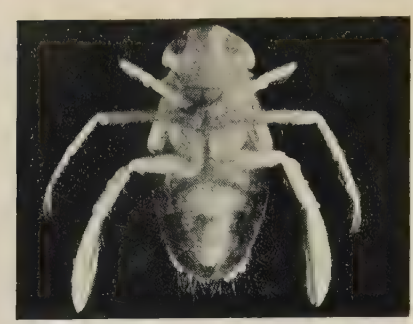


2.

THE FIVE INSTARS OF CORIXA PANZERI (dorsal view).

1=1st instar nymph, × 25. 2=2nd instar nymph, × 18. 3=3rd instar nymph, × 8.
4=4th instar nymph, × 4. 5=5th instar nymph, × 3½.

To face page 54.



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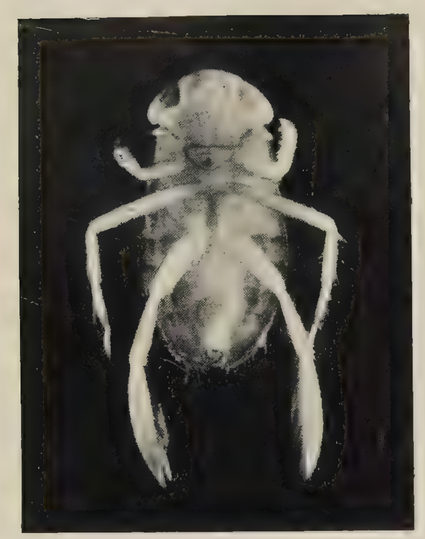

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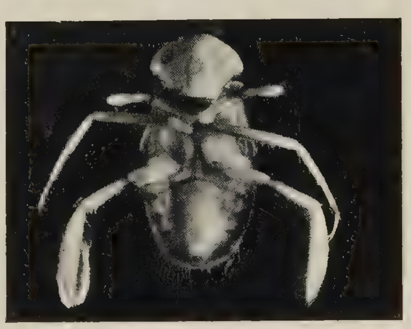

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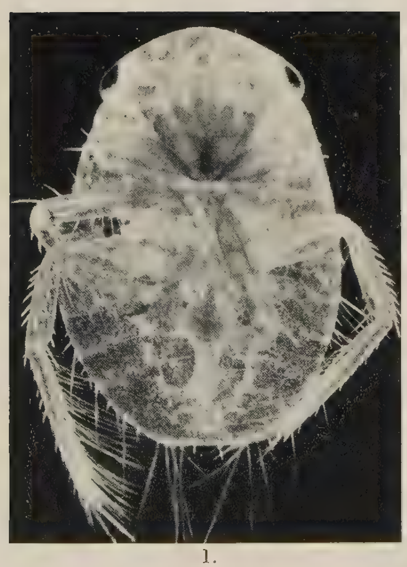
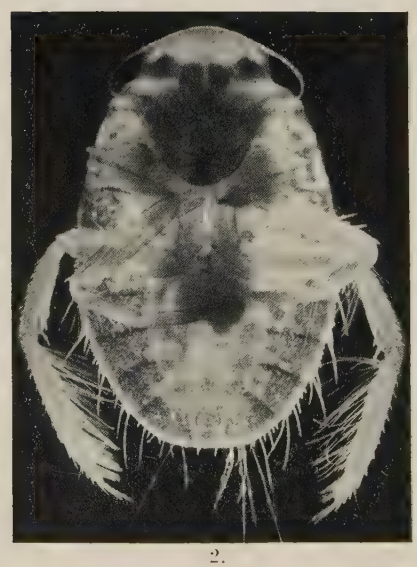


1.



2.

THE FIVE INSTARS OF CORIXA PANZERI FIEB. (ventral view).
1 = 1st instar nymph, × 25. 2 = 2nd instar nymph, × 18. 3 = 3rd instar nymph, × 8.
4 = 4th instar nymph, × 4. 5 = 5th instar nymph, × $3\frac{1}{2}$.

where apparently only three segments are partially delimited in a similar way to the division of the meso- from the metanotum in the first nymph of *C. panzeri*. The three dorsal abdominal glands (fig. 3) are present, and are almost certainly functional since their apertures can be seen ; the corresponding nymph of *C. monticelli* has apertures to the two posterior glands only in abdominal segments four and five. In most specimens the first gland, in segment three, is smaller than the others.

The palae, or first legs, in this instar, are divided into three joints, coxa, femur, and tarsus, the tibia being absent. The tarsus, which is 0·5 mm. long, has, on a much smaller scale, the same shape as in the imago, convex dorsally and concave ventrally, with a slight anterior ventral ridge. Anteriorly and posteriorly there is a thin row of long setae. The width of the tarsus is small in proportion to the length compared with later instars and the imago.

The second pair of legs, used for ' perching ', are in all instars very similar to those of the imago. The lengths of claws, tarsus, and tibia and femur are given in Table II. In some specimens the claws are as long as, or slightly longer than, the tarsus.

In the third pair of legs there is in the tarsus practically no indication of the ' paddle ' shape characteristic of the imago, and claws are present, structures which disappear as soon as the ' paddle ' appears. The tarsus is 1 mm. long, while the claws are 0·15 mm., the tibia measures 0·6 mm. and the femur 1 mm. An indication of a characteristic feature of the adult tarsus is present, a somewhat sparse fringe of long hairs, which rises from the postero-dorsal edge, a similar fringe of shorter, even sparser hairs arises from the anterior edge. These fringes thicken progressively at each instar.

The Second Instar (Plates **2** & **3**).—The nymph is of a rounded oval shape, and is on an average 3 mm. long and 1 mm. wide ; it is thus more elongated than the first instar nymph, owing to the greater elongation of the abdomen as compared with the combined head and thorax. The latter average 1 mm. in length, while the abdomen is 2 mm. The length of the head and thorax is very little more than that of the same region in the first instar. The dorsal abdominal ' visceral hump ' extends further laterally than in the previous instar, but there are still wide lateral ' flanges '. The ventral ' hump ' has not broadened so much in comparison.

The coloration is very striking ; there is a uniformly dark grey background, dorsally and ventrally, with a black lateral border to the abdominal segments, and two darker patches where the flanges abut on to the dorsal ' visceral hump '. The posterior edge of the metanotum is also marked with a dark border. The three additional glands are also indicated by black patches of a characteristic shape (fig. 3). In contrast to this is the deep crimson of the eyes. On the thorax there is, dorsally, a thin white longitudinal line, as in the first instar, and also a transverse white line across the metanotum, dividing it into halves. The black and grey coloration appears to be unusual in Corixid nymphs (Griffiths 1945). The pigmentation and chitinization do not appear to be as well developed as in later instars.

The head shows the same feature as was noted in the first instar, the small area occupied by the eyes compared with the total area of the head. Each eye, viewed dorsally is 0·2 mm. wide, while the distance between the eyes is 0·8 mm. The length from the vertex to the tip of the rostrum is 1·2 mm., and that from the posterior edge of the head capsule to the vertex is 0·6 mm. These measurements, compared with those of first instar nymphs, indicate a marked elongation of the rostral area in relation to that of the posterior region of the head. Correlated with this is the presence of four lines on the dorsal surface of the rostrum as against three in first instar nymphs.

The thorax (fig. 2) is now clearly divided into three segments. The lateral regions of the mesonotum are prolonged posteriorly into the rudiments of two wing pads, as shown in fig. 2. Those of the metanotum are as yet absent. The rudimentary wing pads are not hirsute.

The abdomen is divided into nine segments and again, in segments three, four, and five, the apertures of the abdominal glands are to be found (fig. 3); those in segments four and five are larger than those in segment three.

The palae still show only three joints, coxa, femur, and tarsus. The tarsus (0·7 mm.) is slightly shorter than the femur (0·8 mm.), and is fringed with long hairs in the anterior and posterior margins., The ventral surface is concave in the median and posterior region, but near the anterior edge there is a slight ridge upon which is to be found a row of very short stiff setae. The dorsal surface is convex. This is the form of the adult palar tarsus, and, apart from growth in length, a slight increase in the number of fringing hairs at each ecdysis, and the appearance of the characteristic male palar pegs in the imago, no further changes take place.

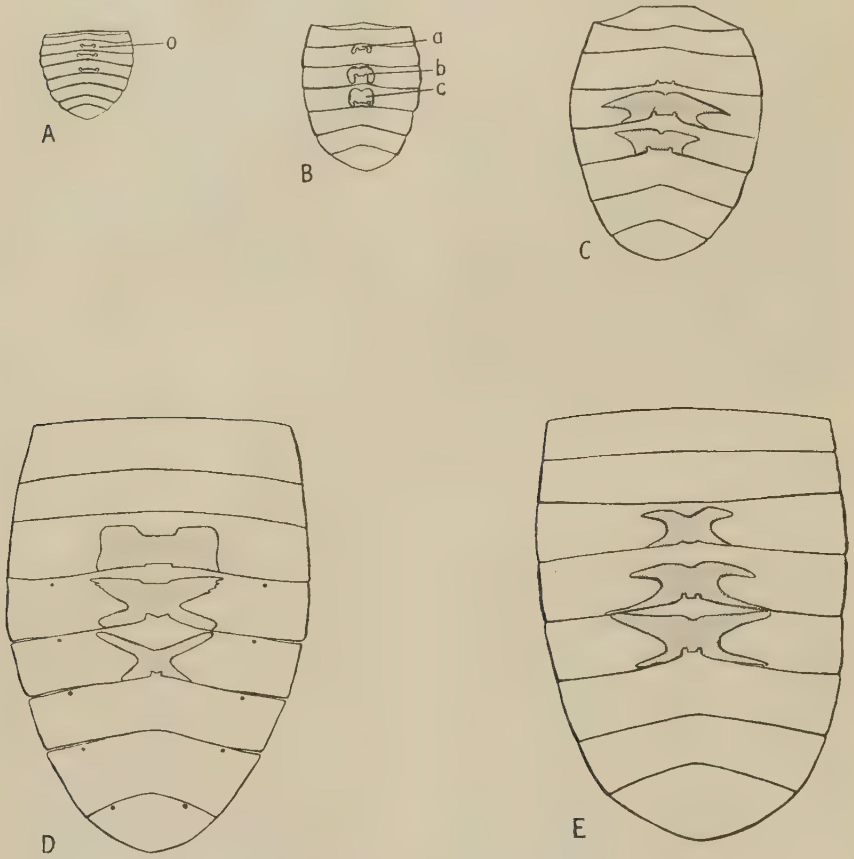


Fig. 3.—Abdomens of the five nymphs of *Corixa panzeri*.
A=1st nymph ; B=2nd nymph ; C=3rd nymph ; D=4th nymph ; E=5th nymph.
***o*=aperture of 1st abdominal gland ; *a*=1st abdominal gland ; *b*=2nd abdominal gland; *c*=3rd abdominal gland.**

The second legs have also the form of those of the adult. The measurements are given in Table II.

The third legs still have claws, but they are shorter (0·2 mm.), in proportion to the length of the tarsus (1·2 mm.), than those of first instar nymphs, and in some specimens they are missing, probably because they are fragile and easily damaged. There is a thin dorsal fringe of long hairs to the tarsus, a little posterior to the anterior margin, a longer thicker fringe having its origin a little posterior to the mid-dorsal line, and a sparse regularly spaced row of short setae on the posterior margin. The anterior margin is slightly convex, but the joint has not yet attained the ' paddle ' shape characteristic of later instars and the imago.

The Third Instar (Plates **2** & **3**.).—The length varies between 4 mm. and 5·5 mm., with the majority of nymphs possessing the shorter measurement. The width of the average nymph is 2·2 mm. ; of the total length, the head and thorax occupy 1·4 mm. Thus the abdomen is seen to have increased considerably in length as compared with the head and thorax. The general shape is more indicative of the imago than in previous instars. There is no longer the marked central dorsal ' visceral hump ' ; it extends further towards the margins and the shape of the dorsal surface is uniformly convex.

The colour is similar to that of instars four and five, and markedly different from that of the previous instar. There is a dark greenish fawn background with very dark brown markings on the posterior dorsal margins of the head capsule and metanotum. The tergum of the first abdominal segment has a very dark grey border posteriorly, and, to a much lesser extent, the posterior dorsal edges of the remaining abdominal segments are similarly marked. The abdomen as a whole has a very dark grey border dorsally. Ventrally the nymph presents a uniform appearance, a slightly lighter tone of the greenish fawn background characteristic of the dorsal surface. The eyes are red. Some specimens show dorsally, paired black dots on each side of the true visceral area of the abdomen. The abdominal gland regions are characterized by very dark brown, almost black markings.

The chitinization is heavy, and possibly correlated with this is the appearance, for the first time, of spiracles.

The eyes now occupy a larger proportion of the total area of the head than in preceding instars ; using the same measurements as before, the proportions are 3·6 : 5. There is now a distinct frontal depression although, as yet, it is shallow. The distance from the vertex to the tip of the rostrum has increased and measures 1·5 mm. in a straight line, but it is actually longer as the surface is convex. There are now five lines on the rostrum. The distance from the posterior edge of the head capsule to the vertex is 0·8 mm.

The wing pads on both meso- and metanotum are now clearly defined, although short and narrow (fig. 2). At this stage the anterior wing pad is shorter than the posterior (Table II). Both pairs of wing pads are hirsute, and a band of hairs across the mesonotum links the hairy coverings of the two anterior wing pads. The density of the ' hairy covering ' varies, in different specimens, from a thick pad to a sparse down. The pronotum, probably as a result of the development of the wing pads, has been pushed forward under the backward extension of the head capsule, and it is very narrow compared with meso- and metanotum. It has a very thin covering of short hairs.

The three abdominal glands (fig. 3) are still functional ; the first is, as usual, less developed than the second and third. Ventrally, the abdomen shows a marked convexity running in an antero-posterior direction in the central region.

The first legs are still without tibiae, but, in this and the fourth and fifth instars, a groove appears in the tarsus separating a posterior rounded region from the anterior region. It is this anterior region which has the characteristic shape of the tarsus of the imago. This groove, at a cursory glance, gives the appearance of another joint, but careful examination has shown it to be merely a groove. The femur and tarsus are the same length (1 mm.). There is a fringe of long hairs, about fifteen in number, along the anterior edge and a few shorter hairs posteriorly.

The claws of the second legs are the same length or a fraction shorter than the tarsus (Table II) ; it will be noticed that, while the tibia and tarsus remain very similar in length in instars two and three, the claws and femur have elongated considerably in instar three.

The third legs have now no claws, and the tarsus has the ' paddle ' shape characteristic of later instars and the imago. The fringes of ' swimming ' hairs are thick and long. The tarsus has elongated (2 mm.), while the tibia (1·05 mm.), and the femur (1·1 mm.) have remained at practically the same length as in the previous instar.

The Fourth Instar (Plates 2 & 3.).—The length varies between 7·1 mm. and 8 mm., the width averages 3 mm. The head and thorax together average 3 mm. long, and the abdomen 4·5 mm. The shape is now approaching that of the adult.

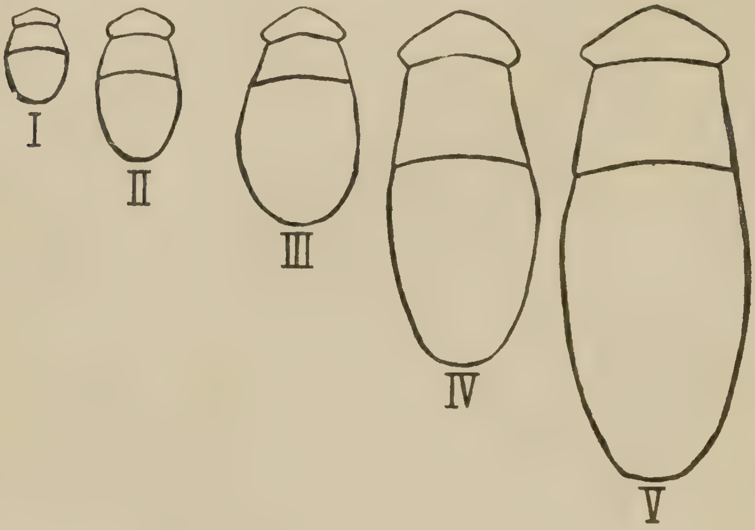


FIG. 4.—Relative sizes of nymphs of *C. panzeri*.
I–V. Nymphs of *C. panzeri*. ×10.

The colour in the living animal is a dark greenish fawn, with very dark brown markings very similar to those of the third instar, but, in addition, the region of the genitalia is darkly coloured in dark brown. The chitinization is very heavy.

The eyes occupy a still larger proportion of the total head area ; the same measurements as before give 7 : 10 as the proportions of eye to head area. The elongation of the head between the vertex and rostrum (3 mm.), continues, while a similar elongation is seen between the posterior edge of the head capsule and the tip of the vertex (1–1·5 mm.) ; but the increase in size appears to be more in the head capsule itself than in the rostrum, which has five lines on it, as in the third instar.

The wing pads (fig. 2) show a marked elongation and broadening, and the anterior pads now extend as far posteriorly, as the posterior pads. The measurements are given in Table II. The hairy coverings of both pairs of wing pads and of the mesonotum are much denser, and the hairs longer than in instar two. The anterior pads have a denser covering of hairs than the posterior.

The three abdominal glands (fig. 3) and apertures are present. There is considerable variation in the development of the first gland ; in some specimens it is as well developed as the second and third, in others it is much smaller. The abdomen as a whole is slightly more hirsute than in previous instars, but the number of hairs, fringing and on the dorsal and ventral surfaces, is always small. Ventrally there is still a dome-shaped area. The spiracles are clearly marked.

The first legs have the same form as in the preceding instar, but the femur has elongated to a greater extent than the tarsus (Table II). The hairs along the anterior edge are longer and are between fifteen and eighteen in number.

TABLE II.—Table summarizing measurements given in text. All figures are in millimetres. Where no alternative figures are given there are no wide divergencies from the figure given in any specimen.

Instar.	I.	II.	III.	IV.	V.
Width	1·2	1·6	2·2	3	3·9
Total length	1·9–2·0	3	4–5·5	7·1–8	9·2
Head and thorax	0·9–1·0	1·05	1·4	3	3·5
Vortex to rostrum	0·9	1·2	1·5	3	3·5
Posterior edge of head capsule to rostrum	0·5	0·6	0·8	1–1·5	1·1
Wing pad (anterior) : Anterior edge of mesonotum. Posterior edge of wing pad	...	...	0·9	2·2–3·0	3·3
Wing pad (posterior) : Anterior edge of metanotum . Posterior edge of wing pad	...	...	1·0	1·8–2·2	2·3
Wing pad (anterior) : Posterior edge of mesonotum. Posterior edge of wing pad	...	...	...	1·8–2·2	2·4
Wing pad (posterior) : Posterior edge of metanotum. Posterior edge of wing pad	...	...	...	1·2–1·8	1·4
1st legs :					
Tarsus	0·5	0·7	1·0	1·1–1·5	1·8
Tibia					
Femur	0·6	0·8	1·0	1·4–1·9	2·0
2nd legs :					
Claws	0·5	0·5	0·7–·08	0·9–1·2	1·8
Tarsus	0·6	0·8	0·8–0·9	1–1·3	1·9
Tibia	0·4	0·9	0·95	1·3–1·8	2·0
Femur	1·0	1·3	1·9–2·0	2·5–3·2	3·8
3rd legs :					
Claws	0·15	0·2			
Tarsus	1·0	1·2	2·0	3–3·8	4·0
Tibia	0·6	1·0	1·05	1·8–2·0	2·3
Femur	1·0	1·0	1·1	1·9–2·5	2·5
Combined width of eyes in proportion to total width of head	1 : 5	1 : 3	3·6 : 5·0	7 : 10	2 : 3

The second legs show an increase in length of all joints compared with the previous instar. There is, however, some variation in the length of joints in different specimens which is not necessarily correlated with the differences in length of the animals as a whole. Average lengths have been given in Table II.

The tarsus and femur of the third legs have both considerably increased in length ; the tibia has elongated to a lesser extent (Table II). There is a long, thick fringe of hairs having its origin just internal to the posterior edge, on the ventral surface of the tarsus. Anteriorly there is a thinner fringe of slightly shorter hairs.

The Fifth Instar (Plates **2** & **3**.).—The length averages 9·2 mm., and the width 3·9 mm. The head and thorax together measure 3·5 mm. The shape is an elongated oval, the elongation being marked, compared with instars three and four. The increase in length of the abdomen compared with that of the head and thorax is the most noteworthy feature of this instar. The colour and markings are similar to those of instars three and four.

The eyes still occupy a large part of the total head area, the proportions, using the same measurements as before, are 2 : 3. They are still red in colour. The length from the posterior edge of the head capsule to the tip of the vertex is the same as in the fourth instar, but the length from the vertex to the distal end of the rostrum has increased to between 3·5 and 3·8 mm., and there are now six lines on the rostrum. The frontal depression has deepened.

The wing pads (fig. 2) have increased slightly in length. Both pads continue to be covered with long hairs. The pronotum is still underneath the posterior region of the head capsule.

The abdominal glands (fig. 3) continue to be functional with the first less developed than the second and third.

The first legs are similar to those of the fourth instar, but the tarsus and femur have increased slightly in length. There are still no tibiae.

The claws of the second legs again show a considerable increase in length. This is possibly because of their assistance in enabling a relatively large aquatic insect to balance, as these are the limbs upon which Corixids stand, when at rest.

Beyond a slight increase in the lengths of all joints the third legs are identical with those of the fourth instar.

Discussion.

The life-history of *Corixa panzeri* presents certain interesting features; in particular, the heavy mortality at the end of the second instar which was mentioned in connection with the difficulty of breeding *C. panzeri* in captivity. An examination of the changes which are to be noted in successive instars shows a possible reason for this. There are certain major differences between second and third instar nymphs, while the differences between first and second, third and fourth, and fourth and fifth, may be described as minor. The attainment of a markedly different facies is probably impossible to all but the strongest nymphs. These changes can be summarized as the first appearance of the imaginal facies. This is evidenced by the replacement of the rounded shape of the second instar nymph by the markedly oval shape characteristic of the imago and the merging of the dorsal ' visceral hump ' into the general dorsal convexity of the abdomen, possibly a concomitant of the greater development of the abdominal viscera, in particular of the alimentary canal. Also the pigmentation and chitinization become heavy, and possibly associated with this is the first appearance of the spiracles, marking a fundamental change in the respiratory mechanism. The eyes in third instar nymphs take up a much larger proportion of the total head area. Both pairs of wing pads appear for the first time, and the second and third pairs of legs also show a striking development. The claws and femur of the second legs elongate, possibly to aid the larger insect to balance itself more efficiently. The now heavier and bigger animal will require a stronger propulsive organ when swimming ; hence possibly the alteration in the shape of the tarsus of the third legs, which has now developed the characteristic adult ‘ paddle ’ shape and fringe of ‘ swimming ’ hairs. The tarsal claws of these legs also vanish. A similar series of major changes can be noted between fifth instar nymphs and the imagines and again there is a heavy mortality just prior to and during ecdysis.

One other interesting feature is the first appearance of the anterior wing pads in the second instar nymphs.

Two papers on the development of two species of Corixidae, ‘ Sviluppo della *Corixa monticelli* n. sp.’ by Caroli (1924) and ‘ The environment, life history and structure of the Water Boatman, *Rhamphocorixa acuminata* (Uhler) ’ by Griffiths (1945), are of interest since they provide a means of comparing the life-history of *C. panzeri* with other species of the same genus. There is a great dearth of descriptions of the life-histories of species of Corixidae and those that there are either do not describe all the nymphs or describe them extremely briefly (Butler, 1923 ; Hungerford, 1923 ; Péneau, 1922) ; the two papers already cited give the fullest accounts. Unfortunately, Griffiths only describes the third, fourth, and fifth instars of *Rhamphocorixa acuminata*, but his general descriptive notes are of interest, since, in several particulars, they endorse the observations on the nymphs of *C. panzeri*, but there are two small differences. Griffith (1945) states ‘ after wing pads appear (third instar) ’, implying that it is only at this instar that they are to be noted for the first time. This is noteworthy in view of the first appearance of the anterior wing pads in the second instar of *C. panzeri*. He also states that the dorsal abdominal glands vary ‘ from bright red to darker blood tones ’. In the nymphs of *C. panzeri* they are dark brown or black. It is noteworthy that these glands are not red in the nymphs of *Corixa punctata* or of *Sigara striata* and numerous other unidentified nymphs of British Corixidae.

The paper of Caroli (1924) is extremely interesting as there are remarkable differences between the life-history of *C. monticelli* and that of *C. panzeri*. The most striking divergence is that *C. monticelli* has only four instars, while *C. panzeri* has five, which appears to be the usual number in aquatic Hemiptera-Heteroptera. Poisson (1933) leaves no room for doubt in his statement, ‘ J’ai pu ainsi constater que *tous* les Hémiptères aquatiques *muent cinq fois et presentent cinq stades larvaires* ’. Further, the first instar of *C. monticelli* hatches in a less developed state than that of *C. panzeri*. Only the mid-dorsal regions of abdominal segments three, four, and five are defined, whereas all the abdominal segments are clearly marked in the first nymph of *C. panzeri*. Another striking feature is the disappearance of the first dorsal abdominal gland in the third instar of *C. monticelli*, while this gland is retained in an active condition until the final ecdysis of *C. panzeri*. Finally, according to the drawing of the first instar nymph of *C. monticelli*, the thorax is also less completely divided into segments than that of the first instar nymph of *C. panzeri*.

Whether the instars corresponding to the second and third, or the fourth and fifth of *C. panzeri* have been telescoped in *C. monticelli* is not easy to decide, but it seems probable that the second and third have been merged. The second instar of *C. monticelli* has well-developed wing pads, and apparently there is an increase in pigmentation and loss of transparency compared with the first instar, comparable with those of the third instar nymphs of *C. panzeri*. The nature of the wing pads in the third and fourth instars of *C. monticelli* suggests that these correspond to the fourth and fifth instars of *C. panzeri*, and further proof of this is the disappearance of the first dorsal abdominal gland in the third and fourth instars of the Italian species. This disappearance is an adult feature, and suggests that these instars correspond to later instars of *C. panzeri*. It would thus appear that this is a case of tachygenesis in the

Hemiptera. The cause of this phenomenon can only be guessed. It may conceivably be due to the very different temperatures at which these species develop. *C. monticelli* is found in a crater lake, possibly of a relatively high temperature all the year round which may speed up the stadia, while the life-cycle of *C. panzeri* is completed in cool water which may tend to retard development, particularly that of nymphs which begin their life-history in August and September.

Acknowledgements.

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I should also like to thank Mr. W. E. China, of the British Museum (Natural History), for his identification of the species and for help in the preparation of the bibliography, and to express my indebtedness to the National Fire Service for permission to collect in the Emergency Water Supply tanks on Chelsea Embankment, and to Mr. D. Kempson for making photographs of the nymphs.

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Key to Plates 2 *and* 3.

Figs. 1, 2.—Note the rounded oval shape ; the thin and granular chitin ; the division of the thorax into two regions in 1, and three regions in 2 ; the rudiments of the anterior wing-pads, absent in 1, present in 2 ; the small proportion of the total head area, taken by the eyes in 1, which has increased in 2.

Fig. 3.—Note the general elongation of the body ; the thicker chitin ; the large area of the head occupied by the eyes ; the development of the wing-pads ; the absence of claws on the tarsus of the third legs.

Figs. 4, 5.—Note the elongation and increase in hairy covering of the wing-pads ; the continuance of the three functional abdominal glands ; the development of the tarsus of the third legs, compared with 1–3.

OBITUARIES.

Thomas Barbour, whose grandfather came from Northern Ireland, was born at Martha's Vineyard, Massachusetts, U.S.A., on 19 August 1884. He died in his sixty-second year at the Phillips House Hospital, Boston, on 8 January 1946. At an early age young Barbour began to display that keen interest in nature that was to prove the mainspring of his life's work. After attending the Browning School, New York, in 1901, he entered Harvard College. There to his delight he was allowed to assist with the herpetological collections of the Museum of Comparative Zoölogy and, while still an undergraduate, resolved that some day he would become Director of the museum.

After graduating A.B. in 1906, he married Miss Rosamond Pierce and departed with his bride on a wedding tour that included India, Burma, Malaya, China, Japan, the Netherlands Indies and New Guinea. Wherever the young couple went they amassed collections that later served as material for a thesis on the ' Zoögeography of the East Indian Islands ', which Barbour submitted for the Ph.D. awarded him by Harvard in 1910. In later years he received the honorary Sc.D. from Havana University (1930), Dartmouth (1935), Harvard (1940), and Florida (1944).

Immediately after receiving his doctorate, Barbour was appointed Associate Curator of Reptiles and Amphibians, thus realizing one of his youthful ambitions, for he had elected to make herpetology the chief field of his endeavour. Provided with ample means, he spared no expense in building up the collections entrusted to his care, so that they almost trebled during the years of his curatorship. Thus the more than 6,000 species or races of reptiles and amphibians in Harvard's collection to-day serve as a monument to Barbour's enthusiasm.

Over a period of forty years, as revealed by his published bibliography (1901–1943), Barbour wrote prolifically on a wide variety of subjects, his contributions to herpetology alone exceeding 200 titles. The profusely illustrated popular work entitled ' Reptiles and Amphibians ', embodying the Lowell Lectures that he gave in 1923, has run continuously (1926 ; 1934) with one revision. The five editions (1917–1943) of ' A Check List of North American Amphibians and Reptiles ', produced in co-authorship with his friend Leonhard Stejneger of the U.S. National Museum, have proved a boon to many workers, though subject to some criticism on account of certain omissions or inclusions.

However, reptiles and amphibians were but one of Barbour's many interests, and his general knowledge of plants, birds, and mammals was a recurring source of astonishment to his friends. He had a prodigious memory for names, not merely of persons and places, but of all manner of creatures. Barbour was wont to disclaim credit for this, saying : ' I have only to see a specimen once, and the object together with its label are photographed on my mind'. His search for specimens to label took him to the Bahamas, Bermuda, Cuba, and elsewhere in the Caribbean. The material assembled formed the basis of ' A Contribution to the Zoögeography of the West Indies' (1914), which served as a companion work to the earlier ' Contribution to the Zoögeography of the East Indian Islands ' (1912).

For Cuba and her people Barbour entertained an especial affection, visiting the island repeatedly in his rôle of Custodian of the Atkins Institute at Soledad. There, through his instrumentality, special facilities for study were made available to biological students. References to this field station and its beautiful arboretum will be found in ' A Naturalist in Cuba ' (1945).

Barbour played an even greater part in the founding of Barro Colorado Laboratory. Barro Colorado, formerly a forested mountain top, had been transformed into an island by the man-made flood that produced Gatun Lake in the Panama Canal Zone. The rich tropical forest of the new island carried an abnormally abundant population of animal life, refugees from the rising waters of the lake. The original scheme, superseded when the laboratory was merged in the Canal Zone Biological Area, was for a dozen contributing institutions to nominate students who might, for a small fee, enjoy the privileges of the laboratory's facilities. During the initial years it was Barbour who bore much of the financial burden. It was he who bought out the banana-growing squatters, installed James Zetek as Superintendent, and with him prepared a site to which one of the Canal Zone buildings was transported to serve as laboratory headquarters.

It was shortly after Barbour's return from Panama that year—1924, I first met him. On entering his office at the Museum of Comparative Zoölogy I was greeted by a genial giant of a man with a friendly smile and curly hair, a lock of which he would coil and uncoil about a forefinger when perplexed. Six feet five inches tall with correspondingly heavy build, he would tell of the time he overheard a Cuban woman exclaim to her companion ' Mira, mira, una ceiba caminando ' (Look, look, a ceiba tree walking), little suspecting that the ' ceiba ' spoke Spanish fluently. Barbour's lively sense of humour made him a delightful raconteur, and on fine days when the staff gathered for a smoke at 11 A.M. on the museum steps he would entertain us with anecdotes of men and affairs.

He himself was a Trustee of Radcliffe College and the Carnegie Institution of Washington, and served on the Advisory Board of the Guggenheim Foundation, and the Councils of Harvard University Library and Press. From 1925–1927 he was President of the Boston Society of Natural History, and again in 1940–1945 under its new title of New England Museum of Natural History. It would be tedious to catalogue all the societies with which he was associated, for, besides being a Foreign Member of the Linnean and Zoological Societies of London, he was a Fellow of the Royal Geographical Society, Royal Asiatic Society (Straits branch), American Association for Advancement of Science, American Academy of Arts and Sciences, National Academy of Science, and New York Zoological Society. He was an Honorary Fellow of the Academy of Science at Havana, Corresponding Member of the Nederlandsche Dierkundige Vereeniging, Member of the American Society of Zoologists, and many another.

It was 1927 when Professor Barbour succeeded to the Directorship, not only of the Museum of Comparative Zoölogy, but of the Harvard University Museums. In the zoological section there followed a whirlwind house-cleaning involving wholesale discarding of redundant exhibits and rearranging of the remainder. Seven galleries were closed, then remodelled to serve as curator's offices or storage rooms for the ever-expanding research collections. The enthusiasm of T.B., as he was generally called, injected new life into the institution and there followed a decade of expansion and great activity for the museum staff, with the new Director guiding and encouraging, but always according the greatest liberty of action to his colleagues.

By some the munificent scale of Barbour's financial assistance to the museum was never fully realized until after his death. Many another struggling institution, or cause, had reason to be grateful for Barbour's open-handed generosity, and many students thankful for the opportunity provided to work their way through college. Truly his passing will be mourned by many, for we shall not see his like again. His was a unique personality that almost to the end retained a boyish impetuousness and enthusiasm for a great variety of things, yet was never too engrossed in personal pursuits to extend a helping hand to those in trouble.

During the last few years Barbour had to restrict his physical activities on account of heart trouble. He occupied the time by recording earlier experiences in a series of five volumes (1943–1946), deriving much satisfaction from their publication. In February, 1944, a blood clot on the lung was followed by pneumonia, but medical skill pulled him through. He was at the museum as usual on 4 January 1946, and in jovial mood that evening. During the night, however, he suffered a cerebral hemorrhage from which he never recovered consciousness. He is survived by his wife, three daughters, and two brothers.

A. LOVERIDGE.

Major **Stanley Smythe Flower**, who died at Tring on 3 February 1946, was the second son of Sir William Flower. He was born in the Conservator's House at the Museum of the Royal College of Surgeons, Lincoln's Inn Fields, on 1 August 1871, and from his earliest days took a keen interest in natural history. He often accompanied his father to meetings of the Zoological Society and, when only eleven years old, is represented in one of Gould's cartoons sitting among various famous naturalists of the day. In view of the manner in which he looked forward to these meetings he was very indignant that he should have been shown yawning. He was also a frequent visitor to the London Zoological Gardens and acquired much practical information in the ways of animals which was of great value to him in later life.

Flower was educated at Wellington and King's College, London. He was commissioned from the Artists' Rifles into the Northumberland Fusiliers (Militia) in 1890, and three years later received a regular commission. He served with his regiment until 1896, and then was seconded as Scientific Advisor to the Siamese Government at Bangkok.

In 1898 he became Director of the Giza Zoological Gardens, Cairo, and occupied this post until his retirement in 1924. These beautiful gardens will be remembered with pleasure by all who had the opportunity of seeing them, and the Director's House was always a centre of hospitality. He was appointed additionally Ranger of Central Africa in 1900, and was responsible for framing the laws of the Sudan Government Game Preservation Department. He made several journeys to the Upper Nile, including the first sudd-cutting expedition in 1900. During his visits to the Sudan he always brought back with him collections of animals, with the result that African fauna was especially well represented in the Giza Zoological Gardens.

He was largely responsible for the introduction of legislation in Egypt for the protection of egrets which in 1912 had been reduced by plumage hunters to only two small colonies. By 1924 these beautiful birds had increased to such an extent that they were a common sight in the cotton fields and many hundreds of them used to roost in the trees at the Zoological Gardens.

During the First World War he served as Commander of the Camel Transport Corps, and later in the Frontier Districts Administration. For his services he was awarded the O.B.E., the Order of the Nile, and of the Medjidieh, and mentioned in despatches.

After his retirement Flower took an active interest in the Zoological Society of London and served on its Council from 1924–36, and was Vice-President from 1927–29. He was Chairman of the British Ornithologists' Club, 1930–32. He was elected Honorary Foreign Member of the American Institute of Ichthyologists and Herpetologists and awarded the medal of the ' L'Institute d'Egypt '. He was elected a Fellow of the Linnean Society in 1909, and after returning to England took an active interest in its scientific meetings.

Flower's zoological publications include ' The Mammalia of Siam and the Malay Peninsula ' (1900) ; a series of reports on the Giza Zoological Gardens containing many valuable notes on the animals in the collection ; the List of Vertebrated Animals exhibited in the Gardens of the Zoological Society of London (1927) ; and especially his series of papers on the Duration of Life in Animals (1925 *et seq.*). These were based on records and personal observations carried on throughout the whole of his life. He had an almost encyclopaedic knowledge of general natural history and with his wide experience could nearly always add something of interest in any discussion concerning the most diverse branches of natural history. He was famous for his skill, gentleness and care in handling animals, who responded uncannily to his love of them.

He married first Sibyl Mary Peckham Wallace, who shared his love of animals and both in Siam and Cairo helped to make the Gardens under his care such a success. After her death in 1938 he married Charlotte Dorothea Stewart by whom he is survived. He had two sons and two daughters.

EDWARD HINDLE.

Prof. **John Stanley Gardiner**, F.R.S., F.L.S., was born at Belfast in 1872. Educated at Marlborough College, he entered Gonville and Caius College, Cambridge, and became interested in zoology at what was perhaps the grandest time in the history of the science. It was the latter end of the golden age of pure morphology, of comparative embryology, and the time of those expeditions to all parts of the world on which our knowledge of the variety of animal life is based. Following the Darwinian controversy, the prestige of zoology stood high among the sciences, and there were many great personalities to support it.

It was under these conditions that for a period of three months in 1896 that Stanley Gardiner was able to join the Coral Reef Boring Expedition sent by the Royal Society to Fanufuti. Sollas, the leader of the Expedition, encouraged the young zoologist to compare the reefs with those of Fiji and of other islands. Thus began Stanley Gardiner's two great personal interests in biology, that of marine expeditions in general, and of corals in particular; interests which led to numerous papers on Fungids and other families of corals, together with observations on the thorny problem of the origin of atolls, and ultimately to his becoming one of the foremost oceanographers.

A second chance soon came when, as Balfour Student, he made an expedition to the Maldives and Laccadives (1899–1901); his work on which earned him the Murchison Award of the Royal Geographical Society. This led to a general survey of islands in the Indian Ocean, with the expedition of H.M.S. *Sealark* (1905), and later his expedition to the Seychelles (1908). As a result of these he became an authority on the Madreporaria, and in later years the material of various expeditions was referred to him; his last paper of this kind being one on Flabellid and Turbinoliid corals, published in 1938.

But his real interest was not in systematics: it was in oceanography and the borderland between geography and biology. In his earlier work he contributed much useful data to the theory of coral reefs. This he summarized and extended long afterwards in his book 'Coral Reefs and Atolls' (1931), based on lectures delivered at the Lowell Institute. The whole structure of the Indian Ocean had a special fascination for him, with its evidence of the action of deep sea currents and the suggestion of ancient land bridges. Long after his travelling days were over he had the great pleasure of initiating the John Murray Expedition of 1935 to the Indian Ocean. His excellent work was well recognized. He was elected into the Royal Society in 1908. He was awarded the Agassiz Medal by the National Academy of Sciences of the U.S.A. in 1929, and only the year before he died the Darwin Medal of the Royal Society.

Many of the results of his expeditions were published in the Transactions of the Linnean Society. In 1936 the Society gave him its highest award, the Gold Medal, in recognition of his work on the biology of Corals, the origin of Coral Reefs and his great work for zoological exploration.

His early travels convinced him of the importance of young zoologists seeing for themselves the animal life of the world and the problems surrounding the conditions of its existence. And when as Professor at Cambridge he could no longer travel himself he did all he could to encourage zoological exploration. He initiated, encouraged, advised and found funds not only for large expeditions, but also for the travels of many individual zoologists. As a Trustee of the Percy Sladen Memorial Fund, an office to which he was twice appointed and which he held at the time of his death, he was able to use great influence to further these things. During his Professorship Cambridge men and women visited Australia, the Pacific Islands, the Red Sea, the Great Lakes of Africa, South Africa, Algeria, The Chaco of South America, Iceland and Lake Titicaca. Of the expedition to the latter the' Times ' newspaper recently said he was the leader : if only that had been true, what pleasure it would have given him !

Stanley Gardiner's early travels kept him away from Cambridge much of his time. But he played an active part in University and College life. He became a Fellow of his College in 1898 and was Dean from 1903–9. In the Department, he was demonstrator of Animal Morphology from 1902 till he became University lecturer for a brief period before his Professorship. He was senior Proctor for 1907–8.

The great value of his knowledge and experience of biology was recognized when in later years he was appointed a Trustee of the British Museum. His advice on fishery matters in particular was of great use to the Government. From 1920 he was for a time Director of Scientific Investigations for the Ministry of Fisheries.

Until 1909 Stanley Gardiner was continually engaged in his investigations or in the work arising out of them. The tasks before him then suddenly changed entirely. Alfred Newton, the Professor of Zoology at Cambridge since 1866, died in 1907. Adam Sedgwick, a sick man, was Professor for but two years before he left Cambridge for the Imperial College of Science ; only, alas, to die a few years later. When in 1909 Stanley Gardiner became Professor, Zoology as a subject had declined from the high place it held before the turn of the century ; the great morphological advance was becoming sterotyped and less productive : five years later the first German war withered the advance of pure biological science even more completely than did that from which we have just emerged.

The phenomenal success of pure comparative anatomy during the 80's and 90's had led some in later years to narrow their definition of Zoology to this part of the science alone. Stanley Gardiner saw perhaps more clearly than anyone else another characteristic of the Zoology of that great period ; an amazing fertility that could give us Haddon the anthropologist, Bateson the geneticist, and Goodrich the morphologist. He saw that the whole future of zoology must depend on the continual encouragement of new ideas and outlooks as the science progressed. The future as Stanley Gardiner saw it in 1920 was clearly set forth by him in his address to section D of the British Association at Cardiff. He asked ' Where do we stand ? ' and his answer was ' we are in danger of burying our live subject along with our specimens in museums '. He advocated the prosecution of every kind of research on the living organisms by observations and experiment.

His Cardiff address laid down exactly the principles he himself followed in building up the school of zoology in Cambridge during the next twenty-seven years. He gave his staff the greatest possible encouragement to pursue their research. They knew that while pursuing it they could count on his support in the face of every difficulty. He did not lead himself ; their work was often outside his own wide range : indeed he sacrificed his own research to the development of theirs. But he knew how to pick men and how to let them develop their work in their own way. He loved to see a man take a new, even an outrageous view on an old problem and to see accepted ideas called in question. When in earlier day, Gaskell shocked all phylogenetic propriety with his heretical ' Origin of the Vertebrates ' it was from Stanley Gardiner among the zoologists that he obtained help and encouragement.

In his teaching Stanley Gardiner loved to present his matter from an unusual angle so as to make the student question the commonly accepted story. In doing this he did not mind trespassing on ground with which he knew he was by no means familiar. His staff learnt to expect the scandalized student ; ' Sir, the Professor has just said . . . ' : what had been said was often unorthodox. The Professor's reply when taxed with such matters was well known ; ' Oh, I said that to make them think '. That he certainly succeeded in doing. To make the student think for himself and to question the traditional view was to him the prime function of a University education.

Stanley Gardiner died on 28 February 1946, nine years after his retirement from the chair. Many will remember his private kindness and his interest in all they did. The magnificient department that he built is a monument to him. His work for marine biology and oceanography was recognized both here and abroad. But his greatest work was the building of a school of research at a time when his science most needed it. Thereby he has influenced the whole course of Zoology in this country. C. F. A. PANTIN.

Henry Haselfoot Haines was the younger son (fifth child) of Frederick Haines (a Trustee of Shakespeare's birthplace) and a grandson of William Haines, the artist (see for him Foster's ' Miniature Painters '). He was born in London, 12 April 1867 ; educated at Margate, St. Leonards and the University College School, London ; and then at Wren's and Cooper's Hill, whence he passed, head of his year and with a Fellowship of the College, into the Indian Forest Service. He was destined for Bengal and having arrived in Calcutta on the last day of the year 1888, was sent to Darjeeling. Thenceforward until 1899 he served in northern Bengal, sometimes in one Forest division, sometimes in another, sometimes within the Himalaya, sometimes in the forests below the mountains. In 1899 he was transferred to the south of the Ganges, first in connection with the working plans for the Singhbhum forests and then in charge of the forests. The transfer was a milestone in his career ; and the year was one of mark in the history of Indian Forestry.

Those whose memory is long enough will recollect that in 1899 Sir George King was President of Section K, Botany, of the British Association, meeting in Dover, and that in his presidential address Sir George criticized the administration of the service to which Haines belonged for its official attitude towards a scientific knowledge of its materials, saying of Forest Officers that they were ' not encouraged to familiarize themselves with the contents of the forests under their charge '. He absolved Haines, mentioning him along with certain others as doing good botanical work ; but the reader may be reminded of a detail which shows that there actually was a leaven working in the Department, for in 1899 the veteran Sir Dietrich Brandis, who had been retired from the post of Inspector General as far back as 1883, came out of his retirement and began at Kew the preparation of his book ' Indian Trees ' that it might serve Indian Foresters not only as a guide to a knowledge of their trees, but as a means of securing the great desideratum of a nomenclature common to all of them from Hazara to Victoria Point. Haines may be regarded as part of the leaven. His transfer to Singhbhum had brought him into unfamiliar forests ; and he set to work to know what was in them, building up a personal herbarium copiously annotated with observations which he was wont to make after a day's work in the forests on the plants he had observed during the work. He continued this for four years. When leave came, he made use of the first six weeks of it to tramp through the other districts of Chota Nagpur collecting diligently and obtaining a knowledge of their vegetation.

In 1903, at a conference of Forest Officers at Jabalpur in the Central Provinces, it was pointed out that no lists existed of the plants of interest to a forester in any of the three Forest Circles of the Provinces. R. S. Hole, who was one of those in conference, immediately came forward with his 'List of Trees, Shrubs and Climbers of the Northern Circle' (1906); and this small book Haines reviewed in 'The Indian Forester' (1907, p. 92). D. O. Witt followed with his 'Forest Flora, Berar Circle' (1908); and this also Haines reviewed in 'The Indian Forester' (1909, p. 277). It fell to Haines to complete the trio by a 'Descriptive list of Trees, Shrubs and Economic herbs of the Southern Circle, Central Provinces'; but this was not to be just yet.

Haines had been marked for special duties and in 1905 was called away from Bengal, not immediately to the Central Provinces, but to Dehra Dun to act as Deputy Director of the Imperial Forest School, and then as Imperial Forest Botanist. The latter appointment gave him the opportunity of determining with some accuracy his Singhbhum collections, as the Dehra Dun herbarium was his to use. He continued to act in various posts including that of Principal of the Imperial Forest College until 1907, when he obtained leave and brought his taxonomic difficulties to Kew. On his return to India after this leave his 'Forest Flora of Chota Nagpur' (pp. vi+654, with an index and map) was published in Calcutta.

He was made Conservator of Forests, Central Provinces, in charge of the Southern Circle; and it was by diligent study of the plants of the Circle that he prepared the work already mentioned. Its publication began in 'The Indian Forester' in October 1912, but, revised, was issued as a book (pp. xxxviii+334) in 1916. And thereby he completed the trio of lists required in the Central Provinces.

In 1914, after a very short spell of service in northern Burma, he was sent back to familiar ground as Conservator of Forests, Behar and Orissa; these had now been politically separated from Bengal. Continuing the work he had already done, he collected during this his last spell of service, materials for his 'Flora of Behar and Orissa' (pp. 1350 with a map). In 1919 he took leave preparatory to retirement and resided in the Royal Botanic Garden, Calcutta, for five months of strenuous work on his collections; then he repaired to Kew to complete in England the book which appeared in six parts in 1921–22. It is a complete flora, that is to say it does not exclude the plants thought unlikely to interest a Forest Officer as the two earlier works had done. He explained in the introduction that experience had taught him the inadvisability of the arbitrary and altogether indefinite line drawn in the so-called Forest floras; and the writer of this notice most emphatically approves his decision to have none of it. As in his other floras the descriptions are from life, being based on his field notes; and the originality they possess is of great value.

On his retirement the Government of India made him a Companion of the Indian Empire.

When his last work was finished he gave his collections to Kew, and having bought a house and land on the little hill which overlooks the town of Wimborne in Dorset, he went to live there and occupied himself in planting his land with all the trees that he fancied. But he was not happy. The adjacent New Forest had seemed beforehand to promise fresh interests at his door; but he found himself offended by the drainage of hollows where rare plants grew, by the conversion of pretty winding streams into straight ditches, by the abolition of fencings and by other like works carried out by the Commissioners to meet a demand for grazing and more grazing from those who were able to put ponies and cattle on to the land, favoured by these Commissioners regardless both of trees and amenities: and he protested in print against the degradation ('Empire Forestry Journal', 1929, no. 8) and in an open letter which he circulated widely under the date 2 December 1928. An artistic feeling in his temperament, clearly inherited, made him revolt against what he saw. The rules of forestry were flouted and he hated the banality of the consequences. A decision finally came to move away from Wimborne when a gaunt terrace, tall and unrelieved by any trees, climbed a low ridge into full view from his garden. He moved, then, to Berriew near Montgomery and on a larger property resumed the planting of trees that he liked. There he was happier ; and there old age overtook him and he died on 6 October 1945.

One may be assured that his plantings were carefully thought out. He had a great love of scenic beauty; and all societies and corporate bodies that endeavoured to preserve it had his support. He loved animals, especially dogs and horses. When, in India, if he carried a gun in his forests, it was as a protection, not in aggression. I. H. BURKILL.

Colonel **J. Hamilton Leigh** was elected a Fellow of the Society in 1896; and was also a Fellow of the Zoological Society. He was born 31 December 1867, at Stockport ; and died 30 January 1944.

From boyhood upwards he was a great lover of sport and natural history ; but perhaps his chief delight was stalking in his beloved highlands (Argyllshire). He also paid many visits to Austria and Hungry stalking chamois and the big Carpathian red deer. In later years he and his wife had three big game and butterfly collecting expeditions to the southern states of Kenya.

He was at first in business, but later took a commission.

After cremation his ashes were, by his request, scattered on the top of his favourite mountain of Strontian, Argyllshire.

He lived at Bindon till 1934, and there had a small stud of Arab horses.

An obituary notice was given in the ' Somerset County Gazette ' on 20 February 1944.

Gustav Senn (1875–1945) in his seventeeth year was looking forward to retiring in July 1945 from his professorship in the University of Basel and to devoting the leisure of his retirement to the completion of his studies in the early history of Botany, which he had been carrying on for some years. On 10 July he was to give his last lecture after a tenure of office of thirty-three years. But, alas, that lecture was never given, for early in the morning of that day he died suddenly from heart failure. So his projected work will never be done as death took the place of retirement. His colleagues in the University of Basel, the members of the Basel Natural History Society and numerous friends and donors had been intending to celebrate his seventieth birthday due in November 1945 by publishing a dedicatory volume of the ' Transactions of the Natural History Society of Basle ' in his honour. All preparations were made and numerous articles contributed, which are now embodied in a memorial volume of the Transactions (vol. 56, part 2, 1945), a copy of which is in our library.

Born in Basel on 9 November 1875, Senn attended what corresponds to a Municipal Grammar School in his native town and then proceeded to the University of Neuchâtel. Already at school he developed a taste for nature study and at the university he took up botany in particular. From Neuchâtel he went on to the university of Basel where Klebs was professor of Botany. When the latter went on to Halle, Senn, a devoted student, followed him, interesting himself specially in the study of Algae. He subsequently went to Kiel for a further study of Algae under Reinke and then spent some time on Plant Physiology under Pfeffer in Leipzig. He continued his studies of Algae by working for a time on Marine Algae at the zoological station in Naples. Lastly to gain wider botanical knowledge and particularly to become familiar with tropical vegetation he visited Ceylon, Java and the Malay peninsula in 1911. Appointed Lecturer in Botany at Basel in 1901 he was promoted to the professorship in 1908 on the retirement of Prof. Fischer.

Senn had a passion for botanical investigations and every moment which he could spare from his teaching engagements and committees he devoted to his researches. These were at first of an algological nature. One of the earliest and most important of these was the article on Flagellatae which he contributed to Engler and Prantl's 'Pflanzenfamilien'. A publication of quasi-physiological nature dealt with the change of shape and position of the chromatophores of vegetable cells. Several papers were published on this topic, dealing both with algae and with different types of cells among Angiosperms.

Senn carried out more extensive physiological experiments in a small mountain laboratory which he had fitted up at Muottas Muraigl above Samaden in the Engadine. Here, with the aid of his assistant, Miss Henrici, he was busy during the vacations in investigating the Transpiration, Respiration and Assimilation of alpine plants at high altitudes. Not many of these investigations were published as Senn had hoped to write a more complete and connected account of the physiology of alpine plants, when he had retired. But that book will not see the light of day.

About 1920 Senn became engrossed in the study of the very early history of Botany, particularly in the work of Theophrastus of Eresos. Reading classical Greek fluently he studied the early writings of the Greek philosophers and naturalists, trying to make out what was original and what had been added to them in the course of centuries. These studies, too, he hoped to continue and complete in his retirement. A good many articles on Theophrastus had already appeared in various periodicals. The most important of these, of which he presented a copy to our society, was a volume of some 250 pages entitled 'Die Entwicklung der biologischen Forschungs methode in der Antike und ihre grundsätzliche Foerderung durch Theophrast von Eresos.'

His interest in these historical researches led him to become one of the founders of the Swiss Society for the study of the History of Medicine and the Sciences of which he was for many years the president and which awarded him an Honorary Doctorate of Medicine. As a result of his eminence as a botanist he was elected President of the Swiss Natural History Society from 1935–40. In 1920 and 1921 he was Rector of the University of Basel. In 1922 he visited Manchester for a term as exchange-professor and gave an interesting course of lectures on the physiology of alpine plants. In 1935 he was elected a foreign member of our society.

Senn spoke and wrote English fluently and wrote an article in English on the Assimilation of the Molecular Nitrogen of the Air by Lower Plants especially by Fungi, published in the 'Biological Reviews', Cambridge, 1926.

He had hoped by the end of 1945 to have completed a comprehensive account of Theophrastus and his work on which he had been working for many years. Alas, Man proposes, but God disposes. Let us hope that some portion of Senn's work on Theophrastus may be in a sufficiently advanced state to be edited by a classical scholar for our benefit.

Senn married a Miss Bernoulli, a member of one of the patrician families of Basel, who only survived him by a few months. His son and daughter are both married. F. E. Weiss.

Freiherr **Karl von Tubeuf**, emeritus Professor of Plant Pathology in the University of Munich, who was born 20 January 1862, and died 8 February 1941, was a link with the very early days of the study of forest botany and forest pathology. His father-in-law was Robert Hartig, one of a family of foresters, and author of the classical works 'Wichtige Krankheiten der Waldbäume' and 'Die Zersetzungserscheinungen des Holzes'. In 1878 Hartig had become a professor in the University of Munich and organized the botanical work of the newly erected Forestry Research Institute. Tubeuf came as an assistant to Hartig, and on the death of Hartig in 1901 succeeded him as Professor and head of the Institute. Tubeuf lectured to forestry students on Anatomy, Physiology, and Plant Pathology, and in connection with these courses regularly conducted excursions into the Bavarian forests. At the same time he continued Hartig's tradition of encouraging independent research by post-graduate students. He took the greatest interest in his research students, and there must be many botanists whose careers were founded on his training in exact methods and independent thought. His excursions were a delightful foil to the laboratory side of the work and were made fascinating because of his wide knowledge of forest trees and their diseases.

Tubeuf himself was a prolific writer. His earlier papers dealt mainly with plant pathology, and his book, ' Pflanzenkrankheiten durch kryptogame Parasiten verursacht ' appeared in an English translation by Wm. G. Smith in 1897. In later years he devoted himself almost entirely to an intensive study of the Mistletoe, culminating in his ' Monographie der Mistel ' (1923).

The ' Naturwissentschaftliche Zeitschrift für Land- und Forstwirtschaft ' appeared in 1903, with Tubeuf and Hiltner as joint editors. From 1905 until it came to an end in 1920 Tubeuf produced it alone. He also edited the ' Zeitschrift für Pflanzenkrankheiten ' from 1916 until the end of 1936. He retired from his professorial work in the autumn of 1933 and was succeeded by one of his former assistants, Professor E. Münch.

In 1934 he was elected an Honorary Foreign Fellow of the Botanical Society of Edinburgh, and in 1938 an Honorary Fellow of the Royal Society of Edinburgh. He was made a Foreign Member of the Linnean Society in 1936.

E. M. WAKEFIELD.

THERE will be widespread regret amongst botanists at the death of **John Lloyd Williams**, one time professor of Botany in the University of Wales. Though a good many years have elapsed since his retirement from active academic life, his name will long be honoured for the research by which he was best known. Though strictly within the limited field of algology, it had a bearing on botanical thought far beyond its immediate field of enquiry, and will always be associated with his name in botanical text-books.

Lloyd Williams started his professional career as a teacher in a small country school at Garn Dolbenmaen, near Criccieth. It was not until he was more than forty years of age that he joined the staff of the late Professor Phillips at University College, Bangor, a post which he left some years later to take up the duties of Professor of Botany at University College, Aberystwyth.

It was during his early association with Professor Phillips, himself an algologist, that Lloyd Williams first found an interest in the field to which he was later to make his major scientific contribution. It is difficult for modern University students to realize that much of the subject-matter of present day text-books is of comparatively recent origin ; that the details of the life-cycles of *Fucus* and *Dictyota* were almost unknown fifty years ago. At that period when botanical attention was largely focused on the meaning of alternation of generations, the fact that so lowly an organism as an alga might show an even more perfectly balanced rhythm of alternating generations than any higher plant, acted very naturally as an impetus to further thought, and incidentally brought the field of algology into prominence as a realm well worth exploration.

During the period of Lloyd Williams's association with University College, Bangor, the shores of the Menai Straits offered him acres of *Fucus* and *Laminaria* spread out twice daily before his eyes ; a challenge to investigation. At the end of last century the existence of a minute alternating phase to the large and well known *Laminaria* had been suspected. The culture of zoids claimed simultaneously the attention of algologists in several countries, and though the credit of first publication of the description of the gametophyte goes to Sauvageau, its existence had been discovered simultaneously by Lloyd Williams. It was not until 1921 that he published in the ' Annals of Botany ', an account of the actual fertilization process, though he had contributed papers on this topic to meetings of the British Association at Bradford in 1900 and at Dundee in 1912.

Just before the end of last century, Lloyd Williams investigated, in conjunction with the late Sir John Bretland Farmer, the life-cycle of *Fucus*. The results of this enquiry which have attained the rank of classics, were published in the ' Annals of Botany ' in 1896, and a year later in the ' Proceedings of the Royal Society '.

Lloyd Williams is, however, best known for his work on *Dictyota*, published in 1904 and 1905. The double tides of the Menai Straits offered him a valuable field of enquiry, and through him, introduced algologists to the idea of periodic behaviour of organisms under the influence of rhythmic variation in factors of the environment ; a fascinating field of study which is as yet by no means fully explored.

Though the list of publications attributable to Lloyd Williams is not a long one, it must be borne in mind that he started his career of research late in life. He had also a trait, by no means uncommon, which combines the greatest vigour in the prosecution of research with extreme reluctance to sit down and write an account of the findings for publication. This regrettable inertia has deprived algologists of the opportunity of sharing that vast store of first hand knowledge of the algae which Lloyd Williams undoubtedly possessed. Perhaps it was partly induced by an early experience. Having sent the manuscript of his findings on the life-cycle of *Dicyota* to be read at the Meeting of the British Association at Toronto, he later discovered that the spermatozoid should have been described as having two cilia and not one. His cable announcing the discovery of the second cilium was not included in the first published accounts, and the number of text-books in which one cilium is ascribed to the spermatozoid of *Dictyota* bears witness to the difficulty of correcting an error once it has appeared in print. Professor Lloyd Williams used to point the moral to his students by referring to himself as the man who rushed precipitately into print with one cilium attached instead of two.

The contribution which a professor of Botany makes to his day and generation is only partially assessed on the criteria of his published works. There is the other side of professorial responsibility, concerned with the education of the student ; the inculcation of scientific accuracy, and above all, the stimulation and transfer of enthusiasm ; the spark of spirit which lights the torch in the minds of colleagues and students alike. In these qualities Lloyd Williams was markedly rich. He was a first class teacher and an excellent field botanist. Snowdonia was his happy hunting ground, a district which he knew intimately. His was a remarkable personality. Spare in figure ; possessed of immense vigour ; a mobile face expressing freely the Celtic fervour of his feelings ; choleric, whole-heartedly amused, frankly incredulous, or kindly considerate, he was forthright in all his dealings. As one of his old students said of him ' one knew where one was with him, but woe betide any one who let him down '.

There was another field, that of music, in which Professor Lloyd Williams was a master. He was an expert in the field of Welsh Folk Songs of which he published several collections. He used to combine botany excursions with the collection of little known songs from upland farms and cottages. He was always much in demand as a conductor at musical festivals and was a friend of the late Sir Walford Davies. To the day of his death he was the vigorous editor of a widely circulated Welsh musical paper known as ' Y Llenor '.

Despite advancing age, Lloyd Williams refused to grow old. To celebrate his ninetieth birthday, the inhabitants of the little village in which he started his career as a teacher, presented him with a walking-stick to mark the occasion. In expressing his thanks for the gift he said that he would find it useful when he grew old.

The more personal details of appreciation have been provided by Mr. W. T. Mathias, an old pupil of Professor Williams, one of a long stream of graduates of the University of Wales who will look back with pride, touched with sadness at his loss, to their memories of John Lloyd Williams as professor, as colleague and as friend.

Professor Lloyd Williams was elected a Fellow of the Linnean Society and withdrew from Fellowship in 1927. MARGERY KNIGHT.

BY the death of the Rev. Canon **Francis William Galpin**, M.A., D.Litt., F.L.S., on 30 December 1945, the Society has lost one of its oldest Fellows.

Galpin was born at Dorchester on Christmas Day 1858, and was educated at Sherborne School and Trinity College, Cambridge. He was ordained Priest in 1883 and spent most of his life in doing active parochial work in the dioceses of St. Albans and Chelmsford. From 1891 to 1915 he was Vicar of Hatfield Broad Oak, Essex, and it was there that he made his wonderful collection of old musical instruments and wrote his standard work 'Old English Instruments of Music' (1910).

Although Galpin will be specially remembered for his work in music and archaeology, as a parish priest he was eminently successful and greatly loved. He was the mainspring of every festival and of all communal activity in the parish, always an active participant in the joys and sorrows of every home in his charge. While men of learning came to his vicarage to benefit from his researches his people came with equal warmth to see the parson. He dug and disclosed the outlines of the great Benedictine Abbey, of which this beautiful village church of Hatfield Broad Oak once formed the nave, he brought to light the early parish records, he was an authority on local lore, and beyond his own boundaries the Essex Archaeological Society can testify to many years of fruitful work, and in particular to his full and careful record of the Church Plate in the County.

In 1915 he became Rector of Witham, and from 1921–1933 he was Rector of Falkbourne. In these two parishes he displayed the same energy and efficiency, besides continuing his researches in music.

After Galpin's retirement in 1933 he lived at Kew, where he gave unstinted help to many clergy in the neighbourhood, and where with his greater leisure he did much valuable work in his study on musical instruments. It was during these years that he became a frequent visitor to the Kew Herbarium and Library, where he delved into the literature of those plants used in the making of old musical instruments. The late Sir Arthur Hort, in his translation of Theophrastus (370–285 B.C.) 'Enquiry into Plants' thanked the 'Rev. F. W. Galpin for his learned exposition of a passage which otherwise would have been dark indeed to me—the description of the manufacture of the reed mouthpieces of wood-wind instruments in Book IV'.

Apart from music and archaeology Galpin also took a genuine interest in Natural History. In 1887, shortly after his ordination, he was elected a Fellow of the Linnean Society, and remained a Fellow until his death, a term of nearly sixty years. During his retirement when living at Kew he was frequently seen at the Society's meetings, and endeared himself to many of the Fellows by his great modesty and by his innate gracious and courteous manner. At the age of eighty-four he wrote 'In the Garden of the Lord', followed by another book on the Trees of Palestine, not yet published. Earlier in his life Galpin had travelled in Palestine.

Galpin was essentially a practical man, even his studies on ancient music having a practical bearing, instruments were to be played upon, not locked away. His own collection (some twelve hundred) he played, mended and maintained himself. His Elizabethan Bible Regal (one of three now extant in this country) was regularly used in the Seven Dials Mission during his

London curacy. He was an ingenious craftsman, his last construction was a replica of the little English sixteenth century piano, the 'Chequer', which he made some five years ago from records in the British Museum. In 1904 he built a large working model of the Roman Hydraulus, or Water Organ, from a fragment of clay statuette unearthed at Carthage. This, with the greater part of his collection, is now in the Museum of Fine Art at Boston, U.S.A., available as he wished, for students to use.

Galpin's researches won him several distinctions—in 1905 he was made an Honorary Freeman of the Worshipful Company of Musicians, in 1936 Cambridge conferred on him the Degree of Doctor of Letters, in 1938 he was elected President of the Musical Association, an office which he held till 1943.

In 1937 Galpin published 'The Music of the Sumerians, Babylonians and Assyrians', and the following year 'The Music of Electricity', a study of the latest developments of electronic instruments.

Galpin married Mary Maude Hawkins, who died in 1942, and is survived by three sons and one daughter. The writer is very greatly indebted to his son, Mr. Christopher Galpin, for much material help with this appreciation, and also to his daughter, Mrs. Willis, who has done all in her power to supply information which otherwise would have been difficult to obtain.

M. L. SPRAGUE.

Miss **Edith Rebecca Saunders**, who died on 6 June 1945, as the result of an accident in Cambridge, was one of the pre-eminent women botanists of the first half of this century. Her long life was entirely devoted to teaching and research and her contributions in both of these spheres of activity were of outstanding importance. Born in 1865, she was educated at Handsworth Ladies College and Newnham College, Cambridge, where, after holding a research studentship, she became a Demonstrator in Natural Science in 1889. For more than twenty years she taught, and organized practical classes for the students of Newnham and Girton Colleges before women were fully admitted to the regular University classes. She later acted for some years as Director of Natural Science studies in her college, relinquishing this post in 1925.

As a teacher she was most successful in imparting to others her own interest and enthusiasm for the study of growing plants, and she had an exceptional knowledge of plant life from her work in the field and in the garden. Many of her students have in their turn made high reputations as teachers and investigators.

In spite of the constant claims of teaching and supervision, Miss Saunders always gave a large part of her time to original research, often of a very laborious character. Early in her career she became interested in the experimental study of evolution and was one of the first collaborators with William Bateson. Mendel's work was still unknown when, in 1895, she undertook breeding experiments on *Biscutella laevigata*, of which a hairy and a glabrous form existed side by side in the Alps. These forms intercrossed readily and her problem was to try to discover how the distinctness of the forms was maintained. A paper on the results was published by the Royal Society in 1897 and she then went on to the study of other plants in which there were hairy and glabrous forms, or characters which we should now describe as dominant and recessive. The republication of Mendel's work in 1900 gave a fresh impetus to these and similar investigations. In December of the following year she collaborated with Bateson in a report to the Evolution Committee of the Royal Society, published in 1902, in which Miss Saunders showed that her results on *Lychnis*, *Atropa* and *Datura* presented simple illustrations of Mendel's principles, while the phenomena presented by the Garden Stock (*Matthiola*) were of a more complex character. The genetics of this form became one of her chief concerns for the rest of her life, and she wrote no less than twenty-two papers dealing with some aspect of her studies on this genus. After 1902, Bateson and Saunders were joined by Punnett, Biffen, Lock, Gregory, Balls, Miss Wheldale (Mrs. Onslow), and others in the investigation of plant genetics, and thus began the modern study of this branch of knowledge in Britain. While the investigation of *Matthiola* was the main subject of Miss Saunders's genetical researches she also worked on *Digitalis*, *Antirrhinum* and other plants.

Her position as a leader in Plant Genetics led to her selection as President of Section K of the British Association in 1920, when her address was devoted to a survey of the position of the subject at that time with special references to the new theories put forward by Morgan that hereditary characters were borne on the chromosomes. After a critical survey of the evidence she concluded that a very large body of facts pointed to a direct connection between phenotypic appearance and chromosome behaviour. This recognition of the importance of cytological phenomena by an experienced worker in genetics, prior to Bateson's acceptance of Morgan's ideas, marks the beginning of a new phase in genetical studies in Britain. She was for many years Treasurer of the Genetical Society and was its President in 1936–38.

Much of Miss Saunders's work had dealt with the occurrence of hairs on the stems and leaves of plants, and this led in 1922 to a paper recording observations on the surface features of the young shoots of many types and the formulation of the theory that the surface tissue in spermatophyte shoots is of foliar origin (the leaf-skin theory of the stem). Subsequently she became more and more interested in morphological problems. Among the many thousands of plants she had raised during her genetical work, she had noticed a number of individuals with abnormal floral structure. In 1925 a paper was published dealing with the gynaecium of the Cruciferae in the light of the abnormal carpels that had been observed. She put forward the view that this structure was derived from four fused carpels, of which two were normally highly modified, and formulated the idea of carpel polymorphism. She considered that the vascular structure of the gynaecium was an important indicator of the way in which it had been built up in evolution, and by studying the bundle system of other flowers she concluded that carpel polymorphism was present in most of the families examined.

A long and comprehensive series of papers in the 'Annals of Botany' and the 'New Phytologist' subsequently recorded the vascular and carpelary structure in a great range of flowers, the results being summarized in a two-volume work on Floral Morphology. All this work aroused very considerable interest in a much neglected subject, but the views put forward by the author met with considerable opposition. Miss Saunders showed herself to be a very stout defender of her position and had no difficulty in showing that many floral structures existed which could not easily be explained by current theories. This is not the time or place to attempt an evaluation of the new views which she put forward, but all are agreed on the interest and stimulating effect of this work on morphological thought. It was certainly seen that some new views of floral structure from the evolutionary aspect were needed.

As was fitting in a good botanist, Miss Saunders travelled very widely and visited North America, South Africa, Australia, New Zealand, China and Japan. Those who were with her will remember her diligent and unremitting study of the plants she saw. She was one of the earliest of the women Fellows of the Linnean Society, being admitted in 1905, after the opening of the Fellowship to women. She served on the Council 1910–15 and was a Vice-President in 1912–13.

She will long be remembered as a conspicuous and dignified figure at meetings of botanists during many years. In her a highly trained and critical intellect was combined with a strong character and steady purpose, but those who were privileged to know her intimately found her a most lovable character and a staunch friend.

H. HAMSHAW THOMAS.